ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 14, No. 17. WEEKLY. | NEW YORK, SATURDAY JUNE 22, 1889. | $3 per annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

AN AMERICAN HONORED ABROAD.

COMPLIMENTARY RECEPTION GIVEN PROFESSOR ELIHU THOMSON OF BOSTON.

A Representative Gathering of England's Electricians at Greenwich.

SIR WILLIAM THOMSON TRAVELS FOUR HUNDRED MILES TO ATTEND—OTHER NOTABLES PRESENT—AMERICA REPRESENTED—SPEECHES, NOTES, ETC.

[By cable from the REVIEW's Special Correspondent]

LONDON, ENG., June 13, 1889.

A notable reception and dinner was given at Greenwich last evening, complimentary to Professor Elihu Thomson, of Boston. The accomplished hosts were Messrs. Laing, Wharton and Down, of London, and the banquet was a great success. Many of the most distinguished English electricians were present, among them: Sir William Thomson, who undertook a journey of over 400 miles in order to be present; Sir Frederick Abel, C.B., F.R.S., and past president of the Institution of Electrical Engineers; Professor Silvanus P. Thompson, B.A., D.Sc., and member of the Council of the Institution of Electrical Engineers; Professor George Forbes, M.A., F.R.S.E., and also member of the Council; Professor W. E. Ayrton, F.R.S., vice-president of the Institution; Joseph W. Swan, ex-member of the Council; Professor John Perry, M.E., D.Sc., and F.R.S., J. A. Fleming, M.A., D.Sc., and member of the Council; Killingworth Hedges, of London, and 50 others prominent in the electrical field in England. Professor Elihu Thomson was highly complimented in the after dinner speeches for his able work, and responded happily and modestly. The English scientists present were mostly greyheaded and venerable, and were much surprised to find this famous American inventor so young a man. The Americans present were: Col. Henry C. Davis, Mr. J. F. Meech, Capt. Willard Lyman Candee, and Mr. Charles W. Price, of the ELECTRICAL REVIEW, of New York.

Allegheny Electric Light Company to the Front.

The task of lighting the wrecked and torn up portion of the Pennsylvania Railroad lying between Johnstown and Altoona, in order that the construction crews could work day and night, has been confided to the Allegheny Light Company, of Pittsburgh. It is no easy work that was undertaken, owing to the terrible condition of the surroundings, and the fact that the road runs right along the brow of the mountain, affording no opportunity for the erection of poles or other supports for the wires. Not only so, but the lights had to be so evenly distributed as to enable a working light to be thrown upon all parts of the track.

The Allegheny Light Company recognized that the requirements of the Pennsylvania Company were so pressing and critical that the very best service must be given by the most experienced workmen, for every hour of time that could be gained in the work of restoring the road to a usable condition meant thousands of dollars to the great corporation. Chief Engineer of the Allegheny Light Company, Mr. R. M. Nasmith, was placed in charge of the work and Head Wireman R. J. Daly and 12 experienced linemen were sent to the scene of operations as the working force. Three dynamos were placed on the train going to Johnstown Wednesday night, with two engines of 10 horse-power and one engine of 60 horse-power, together with a large quantity of wire and other necessaries. The three dynamos represented a power of upward of 50 lights. No time was lost in transporting this plant to Johnstown, and in transferring it across the wrecked area of the city. One of the linemen who aided in getting the plant into operation gave the following description of the difficulties that beset the paths of the light force in getting the plant established, subsequent to his arrival last night from Johnstown:

"When we reached Woodvale we found a force of 3,000 men at work on the track and were told a large number of workmen were scattered along the line of the road all the way up to Lilly's, and the magnitude of the job of repairing the road may be imagined when it is remembered that 25 miles of road and seven bridges were washed away almost entirely. It was at first proposed to erect poles and run a wire for the whole distance, with lights at whatever places were in the worst condition. But this was found not feasible and it was determined to separate the material into three plants and so arrange the lights as to cover as much space as possible. It was dangerous work climbing along the mountain side stringing wires to trees and points of rock, but hard work was done and the 50 odd lights were so arranged as to go as far as possible. The engines and boilers will be moved along in the rear of the railroad, workmen and the linemen will take care of the wires and keep them out of danger. It's a big job and required almost continuous work, and is hardly finished even now. But the railroad people will have plenty of light on the situation."

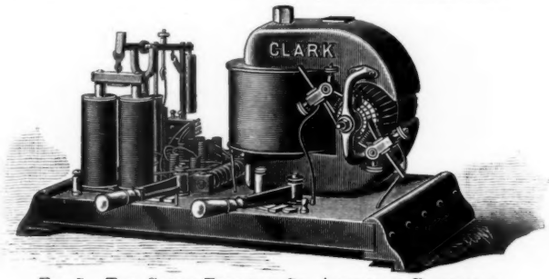

FIG. 5.—THE CLARK ELECTRIC CO. AUTOMATIC REGULATOR.

Long Distance Telephony.

TO THE EDITOR OF ELECTRICAL REVIEW:

Sir—It appears to me that in your leaderette of May 18th, you have not correctly applied my formula to long distance telephony. Not only do I show that speaking is possible between New York and Buffalo, but that it is easy between New York and Chicago, and not impossible between New York and San Francisco. The difference between Messrs. Jacques and Wadsen and myself is simply this: that they take the commercial limit, and I take the possible limit of speech. The accuracy of my formula is confirmed by daily experience. I fear that those who do not accept it have not taken the trouble to understand it.

Dr. Wietlisbach's figures are wrong. He has made a serious mistake in the value of the microfarad in his original paper.

Yours faithfully,

W. H. PREECE.

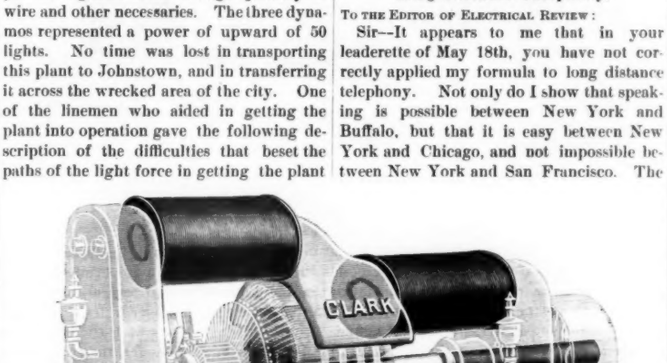

FIG. 2.—THE CLARK ELECTRIC CO. ARC DYNAMO, SHOWING INTERIOR FIELD.

The Clark Company's Arc Lighting Apparatus.

The accompanying illustrations show the new apparatus of the Clark Electric Company. The dynamo has been mentioned in these columns before, but as now presented shows some points of interest in details, such as an unusually long and deep commutator, provided with two independent brushes on each side, either one of which is well able to carry the current, thus allowing the brushes to be changed or turned over while the machine is in operation. The shaft, as will be seen, is very strong, is made of cast steel and runs in gun metal bearings. The armature cores are made of iron wire, insulated with cotton and wound into the proper form. A better division of the iron is thus obtained than by making the cores of sheet iron rings with insulating material between them, but as the core in this method of construction is laminated in both directions instead of only in one, its magnetic resistance is somewhat increased, which is a serious objection to such cores in most machines. In these machines, however, the pole pieces of the field magnets are presented not only to the outside of the armature, but to its inner surface as well, and by this means an enormous increase of the polar surface is secured, which is claimed to render the wire cores of these machines more effective than a sheet iron core. The machines are shunt wound, and are claimed to be the only high tension arc light machines so constructed. They are calculated throughout to secure the highest possible efficiency, and it is stated that after a long run no portion of the machine is ever found uncomfortably warm to the hand.

The arc lamps shown in cuts Nos. 3 and 4 are storm proof, and do not require any hoods or other clumsy devices to protect them. The binding posts are on the under side of the case and will not become short circuited by sleet or snow. The switch is also on the under side of the case where it can be seen by the person operating it. These lamps have been exposed to the worst storms of the past winter, and although at times completely covered with ice and snow, they have never failed to start when the current was turned on. The movement is claimed to be the most powerful ever put into a lamp. The moving parts are heavy in proportion, the carbon holding rod alone weighing 16 ounces.

Fig. 5 shows the new automatic regulator, patent on which was issued June 4, 1889.

The principles on which this apparatus works will need a word of explanation. The dynamos made by this company are shunt wound, and instead of using an adjustable rheostat in the field magnet circuit, as is the usual practice with machines of this class, the Clark Electric Company vary the exciting current by means of an adjustable counter electro-motive force. This is accomplished as follows: The small armature shown in the cut is included, by means of its brushes and commutator, in the field magnet circuit of the dynamo; the armature is simply a small Siemens, but wound with a large number of turns of wire; as the current passing through it is very small (in the arc machines never exceeding $\frac{1}{10}$ of an ampere), the wire of this armature is quite small. The armature revolves in the field

as shown, and when the current passes it becomes a motor and, of course, sets up a counter electro-motive force, the amount of which will depend upon the velocity of revolution of the armature, and the strength of the field in which it revolves. The speed of the armature is limited to a certain number of revolutions per minute, by means of a small belt running from the pulley on the armature shaft to another one on the dynamo, or a line shaft or some other revolving shaft whose speed is constant. As the speed of the armature cannot change, its counter E. M. F. can only change by reason of a change in the magnetic strength of its field magnets. The main current on its way to the line passes through the coils of the regulator field magnets, and thus supplies the field in which the regulator armature revolves. If from any cause the main current should increase in strength, it will at once cause an increase in the power of the field of the regulator, and an increase in the counter E. M. F. of its armature, which being opposed to the exciting current of the dynamo field, reduces that current at once, and with it the strength of the magnetic field of the dynamo. This at once reduces the generating power of the dynamo and brings the current back once more to its standard strength. If the strength of the main current should decrease for any reason, the opposite action will take place. The regulator field magnet decreasing in strength, the counter E. M. F. of its armature diminishing, and the current through it and the field magnets of the dynamo increasing, thus restoring the strength of the main current. There is another piece of apparatus included in the regulator and shown at the back of the cut. It consists of a solenoid, located in the main circuit, whose armature is attached to a lever. The other end of this lever carries a sliding contact piece, which slides over a number of sections or contacts of copper. A number of small spirals of German silver wire are connected to these contacts, and arranged so as to form an adjustable shunt for the field coil of the regulator (whose resistance in the 30 light regulator is only $\frac{1.5}{1000}$ of an ohm). By means of this arrangement, when the main current falls a trifle, the resistance of the German silver coils is diminished, and a greater portion of the main current is shunted through them, instead of passing through the field magnet coils. This of course causes a further reduction of the magnetism of the regulator field magnets, the reverse action taking place when the current rises.

It will be seen by this description that the regulating power depends upon the disturbance which is to be corrected, and the *greater* the disturbance the greater is the regulating power, and as it is not *necessary* that anything should move, the regulating influence can be exercised to a great extent instantaneously, while the *entire* power of the regulator can be exerted in the fraction of a second that is required for the lever of the solenoid armature to move. It is stated that the 30-light regulator exerts a counter E. M. F. under extreme variations of the main current, ranging from three or four volts to 700 volts, which is enough to control the dynamo under the most violent changes of load, and as there is no train of gears nor ratchet movements to be put in motion, the regulation is accomplished in much less time than with any other device in use.

The simple form of ammeter, as shown in Figure 6, is supplied with each plant.

The Clark Electric Company, under the able management of Mr. James H. Seymour, has reached an enviable place in the arc lighting field, where it will be heard from actively in the near future. The offices of the company are now at 159 Chambers street, New York, but more commodious and central headquarters on Broadway will soon be established.

—— The electric light plant which illuminates the City of Titusville, Pa., is just started in operation, and the streets for the first time are flooded with light. The plant consists of a 60-arc light dynamo and lamps manufactured by the Van Depoele Electric Manufacturing Company, of Chicago, Ill.

Electricity on Ships.

There are innumerable devices by which electricity is made useful on board ship. The value of the search light cannot be estimated, as scouting parties, torpedo boats or swift steam launches can be detected a mile away on the darkest night. As a motive power for small machines it is invaluable, and on the "Chicago" will be brought into play for training the huge guns of the main battery. It is used also for discharging the rifled ordnance and the entire system is under the absolute control of the commander from his position in the fighting tower. He requires no uncertain assistants to place him in communication with the various departments of the complex machines. Electrical devices perform all the duties, transmit the orders and control the movements with far greater accuracy and safety than would be possible by the old methods.

The simple pressure of a button endows the huge monster with life and activity, causing 10,000 tons to glide smoothly through the water at a speed of 20 knots. At the touch of a second button the great shields swing noiselessly aside and huge apertures are disclosed, filled the next instant by powerful rifled breech loaders. There is a hush, a moment of expectancy, as the commander appears through the little slot on a level with his eye in the tower, touches a third button, and the cruiser vomits forth sheets of flame. The long steel shot dart through space at the rate of 2,000 feet in a second; bow, stern and broadside respond in one terrific roar, and, crash! the fabric trembles 'neath the simultaneous explosion of 6,000 pounds of powder, and 12,000 pounds of metal are sent whizzing through the air by means of the electric slave of the dynamo.

The merest motion of the little polished lever directly in front of the captain brings the powerful searchlight into action and sends a dazzling beam through the dark void. To the left protrudes still another concave innocent appearing globe, which controls a silent, though potent and death-dealing auxiliary. A slight click is heard, a puff of white smoke and the Whitehead torpedoes glide from their smooth tubes and are driven through the water at the rate of 30 miles an hour. An electric bell signals the officer in charge of the quick firing and machine guns when to play his part, and ere the gong has ceased to vibrate, thousands upon thousands of explosive projectiles are flying through the air at the rate of 1,900 feet per second.

A FEARFUL RESPONSIBILITY.

The latest electric appliance is a system of engine room telegraph, invented by J. B. Wallis, an Englishman. It has been thoroughly tested in the royal navy, and adopted on her majesty's ships "Camperdown," "Rodney" and "Aurora." It is also fitted to the "Magicienne" and the "Marathon," two second class twin screw cruisers. The Wallis system comprises an engine room telegraph, a revolution order telegraph and a steering telegraph, the principle being the same in each case. The engine room telegraph consists of a combined transmitter and reply indicator, inclosed in a case mounted on a pedestal. This instrument has a dial, around which the orders to be transmitted are distinctly marked, and a handle at the back turns a pointer to the desired command.

The moving of the handle or lever gives the "attention" signal to the engineer. The engineer putting his lever over causes a bell to be sounded on the bridge, which calls attention to the fact that he is acknowledging the order and repeating it back. The revolution telegraph is a simple means of transmitting to the engineer the number of revolutions at which the commander wishes the engine to run. The admiral may signal to the fleet that he is going at 70 revolutions, which signal has to be repeated to the engineers, in order that all the vessels may keep in line with the flagship. The steering telegraph is another application of the same principle. The transmitter and receiver are similar to those of the engine room telegraph, the latter being ingeniously attached to the rudder, which makes the record automatically.

In connection with the steam steering wheel, which in the fighting tower of an iron-clad is directly under the commander's control, he has at his disposal a terrible and decisive weapon once it is put in motion. Projecting a number of feet in advance is the ram attachment, its proportions and deadly qualities concealed under water. Emerging from whirling clouds of battle, guided by the will of the commander, the great fabric, impelled by the combined strength of the immense engines, with furnaces glowing and steam hissing, the cruiser rushes straight onward prepared to crash into its opponent.

A single hand guides the modern engine of war that the next instant may be tearing and rending solid oak and steel plates that have afforded protection and a home for hundreds of brave men. To inflict such a blow involves the life or death of the entire ship's company, and with the destruction and sinking of the ironclad hundreds of human beings are ushered into eternity. It is a fearful responsibility to assume, a tremendous power to be vested in the hands of one man, and well may the commander of a modern cruiser pause, weighing all the mighty considerations involved ere he immures himself in his fighting tower wherein lies life or death, only to be let loose at his will and bidding.—*New York World.*

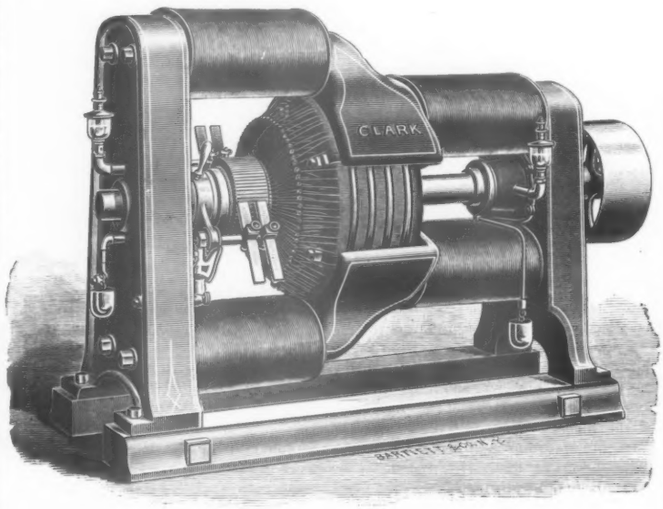

FIG. 1.—THE CLARK ELECTRIC COMPANY ARC DYNAMO.

More Danger From Electricity.

[*From the Pittsburgh Commercial.*]

The human piano fiend is having his field of labor encroached upon by a piano played by electricity. The dangers that menace the tranquility of the community constantly grow.

Photometric Measurements of Arc Lamps.

BY W. WEDDING.

The following is a summary of a memoir recently read before the Berlin Society for the Promotion of Technical Industry:

Dr. Wedding remarks that the luminous intensity of arc lamps is as yet not satisfactorily determined. All kinds of glow lamps have been tested at various potentials and at different angles of eradiation, and decisive results have been obtained which are generally marked on the lamps themselves. It has been said that the arc lights Unter den Linden give an illumination of 2,000 or even 5,000 candle power. But what is the meaning of these figures? Do they express the intensity of the light with or without a globe at a certain angle or do they indicate the mean spacial intensity? On the other hand, it has been determined by direct measurement that these lamps have a mean spacial intensity of only 500 candle-power, and the public was amazed on contrasting such figures as 500 and 5,000.

To decide the question as far as the lamps Unter den Linden are concerned, the Universal Electricity Company consulted Prof. Slaby, the director of the electro-technical laboratory of the Imperial Physical Institute, who commissioned the author to carry out the investigation.

As the distribution of light from arc lamps is very unequal in different directions, a single measurement is not sufficient. It is necessary, at least, to measure through a quadrant from the horizontal to the vertical plane, and where the lamps serve to illuminate a covered space, from the vertical past the horizontal to the vertical again in the opposite direction.

In order to carry out the measurements at different angles, all determinations hitherto have been effected with mirrors. Upon these the rays fall at different angles—measured each time—and reflected thence into the photometer. The co-efficient of absorption of the mirror, must of course, be known. Investigations of this kind were made in 1882 at the Munich electrical exhibition, and since by Herr von Hefner Alteneck in the establishment of Siemens and Halske, who has ascertained the weakening of the light by glass shades of different kinds. Arc lights were again examined in 1885 at the Vienna Electrical Exhibition. Lastly, I must notice the measurements executed at the Franklin Institute in Philadelphia with especial reference to carbons prepared in different manners. All these determinations have been effected with the aid of mirrors. In the Munich report it is mentioned that special care was taken in centering the carbons, as the distribution of light is otherwise very unequal.

The author's researches involve nothing new in principle and refer only to a single arc lamp, such as those fixed Unter den Linden, *i. e.*, the well-known Siemens "differential lamp." This lamp was fitted up in his laboratory by one of the engineers of the General Company of Electricity, and, according to his statement, burnt normally with a current of 14-15 amperes and an E.M.F. of 48-52 volts. The company supplied also three glass globes of different thickness and a reflector.

The lamp was fed by a Schuckert compound machine actuated by a gas motor, which was very carefully regulated, since small irregularities greatly interfere with photometry and yield useless results. An additional resistance of about three ohms was introduced in the circuit of the lamp, and a second resistance of ¼ ohm, at which the potential was measured with a torsion galvanometer. The intensity of the current was deduced from the potential and the resistance.

The same galvanometer was applied to the lamp by means of a commutator, in order to determine the potential at the clamps, so that both current and potential could be observed at one and the same time. As soon as the current reached the exact strength of 14 amperes a signal was given by the assist-

ant in charge of the galvanometer, and whilst he determined the potential at the clamps the position of the photometers was read off by the author and another assistant. The observations were made, therefore, always at 14 amperes; the accompanying potential varied between 48 and 52 volts, and was mostly 49 or 50 volts, and fluctuated during a series of observations for an entire quadrant not more than one per cent. The length of the arc was photographed, and amounted to 2-3 millimetres. The photographic image was taken at right angles to the direction in which the measurement was executed. All the measurements were effected without a mirror. The lamp was hung to the ceiling by means of a pulley, and could be drawn up to the height of 8 metres above the work-table, so that both the horizontal and the perpendicular rays, with all intermediate positions, could fall into the photometer.

The photometer used was that of Bunsen in the form designed by Elster.

As the height of the room enabled the author to dispense with mirrors, he was in a position to measure the strength and the distribution of the light in two diametrically opposite directions. By this means the difficulty arising from the carbons burning unequally on opposite sides was obviated. The author had merely to measure through the quadrant on the left and the right and to deduce the mean intensity from the corresponding values on each side.

The unit taken as the basis of the measurements is the German normal candle, with a flame height of 45 millimetres. In the explanation given along with these candles the height of the flame is specified as 50 millimetres, but at this height it burns unsteadily, whilst at 45 millimetres it burns much more steadily and gives off exactly as much light as the English normal candle (spermaceti), with a flame 45 millimetres in height.

As the arc light cannot be directly compared with the candle, which is too feeble, an intermediate standard of comparison is needed—a matter much less simple than it seems at first sight. The light of the arc lamp appears white to our eyes, whilst that of the candle, the glow lamp, or the gas flame is yellow or red. Therefore, in photometry we have the unplesant difficulty that the oil spots do not disappear, but appear red on the one side and blue on the other. Hence we are compelled to judge when the outlines of the spots appear equally indistinct. This seems impossible to the inexperienced observer, but after having made a few hundred readings the eye becomes so habituated that the colors are disregarded. In order, however, to minimise the difficulty, flames for comparison are sought which appear white to the eye, but which are not necessarily the largest lamps.

Since glow lamps could not be used for comparison, gas was adopted. Two so-called "signal burners" were selected on account of their great constancy, their compact form, and the fine clear light of 25-30 candle-power. To each was attached a gas meter and a pressure regulator. Nevertheless, small fluctuations cannot be avoided with gas burners.

For the measurement the most favorable time was selected, *i. e.*, in winter from 5 to 8 P.M., and in bright weather from 9 A.M to 3 P.M. To compensate fluctuations as far as possible, all the gas burners were lighted in the work-rooms adjacent to the photometric room. The procedure in a measurement was as follows:

We have a horizontal plane in which the two comparison flames are at points which we will call A and B, whilst between which are the two photometers, P and P'. Perpendicularly over the middle point between A and B hangs the arc lamp L, at a variable height, c. Right between A and B is a black cloth used for screening off either light as may be required. In the first place, the two gas burners were adjusted to exactly the same degree of brightness, *i. e.*, a photometer was placed exactly in the middle between A and B, and one of the flames was regulated until exactly equal in luminosity to the other. One flame was then screened off, and the other was measured very accurately in comparison with a German normal candle.

The arc lamp was then kindled, and the photometric operation was begun in about 20-30 minutes. The two photometers were displaced, and the inclination of the paper screens in each photometer was regulated to an equal incidence until the illumination of the oil spots was equal. If it was found after commutation that the current had remained at the same strength (14 amperes) a second reading was taken by the three observers. A third value was rarely obtained. It was then necessary to wait for about two minutes until the lamp was regulated

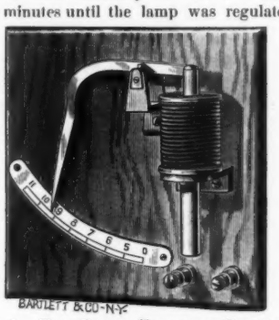

FIG. 6.—THE CLARK ELECTRIC COMPANY AMMETER.

again. On the average, four observations were made for every angle. It was found essential to measure both quadrants through in 12-14 different angles in the shortest possible time, which was effected in 1½ hour.

The details of the author's results are given in a series of 11 tables, with the aid of 23 diagrams. It appears that each lamp suspended in Unter den Linden, when fitted with globe and reflector, gives out an illuminating power not of 5,000 or 2,000, but only of 510 normal candles, which approaches fairly to Herr Elster's determination of 500 normal candles.

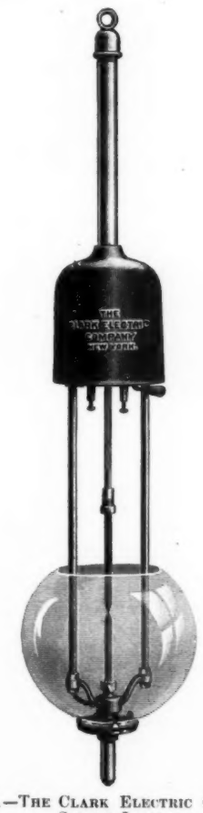

FIG. 3.—THE CLARK ELECTRIC COMPANY SINGLE LAMP.

—— The Board of Trustees of the village of Port Chester have unanimously decided to have the streets lighted by electric lamps and have instructed the Committee on Street Lights to enter into a contract with the Citizens' Gas Company, who were granted a franchise for electric lighting in August, 1887, to furnish 40 electric lamps of 1,200 candle power, to burn all night. Either the Brush or Thomson-Houston systems will be used.

Tobin Bronze Drop Forged Commutator Bars.

Since it has been shown that Tobin bronze can be drop forged from rolled rods as well as copper, the demand for drop forged commutator bars of this metal has been on the rapid increase.

The first to prove the utility of the metal for this purpose, were Billings & Spencer, of Hartford, Conn., who have already patented a process for making drop forged copper commutator bars. Its advantages over cast bronze or copper are its freedom from unsoundness and uniformity of texture. In point of endurance its superior hardness, when compared with drop forged copper commutator bars, it is claimed, renders it in this respect more particularly adapted for use on electric railway cars.

Who Knows How Much Will Kill?

Among the many electricians interviewed in regard to the effect upon men of heavy charges of electricity is M. R. Muckle, Jr., manager of the Keystone Electric Light Company of Philadelphia. Mr. Muckle says that, about a year and a half ago, an employé became careless while making a house connection, and thoughtlessly picked up both ends of the wire. "He was," he said, "immediately thrown to the ground, still holding the wires, which he retained in his grasp for three minutes. His assistant ran to the man, shook him, and inquired 'are you dead?' but received no response. He then called the foreman, who jerked the unfortunate man out of the circuit. He appeared to be dead and an ambulance was summoned. Meantime the man was laid upon his back, but soon revived and sat up, and an hour later he was all right, except that his hands were badly burned, and he went home unassisted. He had been temporarily paralyzed. He said he was conscious for some time after receiving the first shock. The man took 10,000 volts of alternating current through his body for fully three minutes, and is alive and well to-day." Another officer interviewed was C. H. Jackson, president of U. S. Illuminating Company. He said: "I know at least half a dozen living men who have taken 1,000 volts of current at various times, and some of them have taken it more than once. There are people who would not jeopardize their life by taking twice as much. It would be absolutely barbarous to attempt to kill criminals by electricity with no more knowledge upon the subject than the State has obtained."—*Philadelphia Public Ledger.*

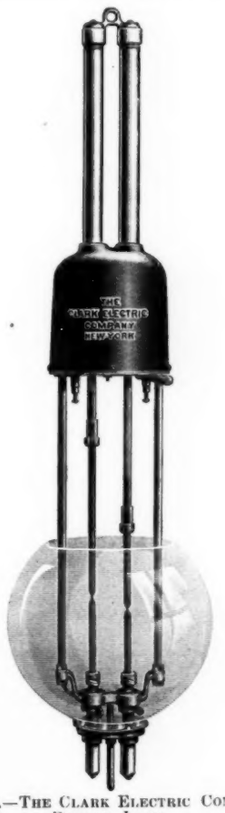

FIG. 4.—THE CLARK ELECTRIC COMPANY DOUBLE LAMP.

Piqua, O.—The Piqua Electric Light and Power Company; capital stock, $25,000.

Toledo, O.—The Schaefer Electric Supply Company, of Toledo; capital stock, $50,000.

Cordele, Ga.—S. J. Sibley, of Marietta, Ga., has organized a stock company to erect an electric light plant.

Chicago, Ill.—American Executing Company, at Chicago; to execute persons who are sentenced to death; capital stock, $25,000; incorporators, Stephen Lawson, M. E. Clear, and Jacob A. E. Iffert.

Nashville, Tenn.—Walter M. Fleming and others, of New York, have incorporated the Suburban Electric Railway Company to build electric railways. The capital stock is $2,000,000. They will probably build an electric railway in Nashville.

Tacoma, W. T.—Inland Construction Company of Tacoma. Capital stock, $250,000. Trustees, T. L. Nixon, Henry Drum, W. H. Woodruff, J. R. Patton and E. W. Smith. Its objects are to engage in the business of constructing railroads, telegraphs and other similar improvements.

Columbus, O.—The Cleveland, Cincinnati, Chicago and St. Louis Railway Company, consolidation of the Cleveland, Columbus, Cincinnati and Indianapolis, the Indianapolis and St. Louis, and the Cincinnati, Indianapolis, St. Louis and Chicago Railway Companies; capital stock, $30,500,000.

San Pedro Cal.—The San Pedro Electric Light and Power Company has filed articles of incorporation. The capital stock is $100,000, one-half of which has been subscribed for. Hellman & Wildt, $5,000; E. E. Peck, $35,000; J. H. Dobson, $5,000; R. D. Sepulveda, $4,000; W. L. Crane, $1,000.

Chicago, Ill.—The Secretary of State of Illinois has issued licenses of incorporation to the following Chicago Companies: The Reform Gas Light and Fuel Company; capital stock, $1,000,000; incorporators, E. A. Bassett, T. Levers and J. Norton. The Chicago Storage Battery Company; capital stock, $150,000; incorporators, Charles S. Raddin, Frank W. Campbell and William H. King.

Fall River, Mass.—A car metal company has been organized here with the following officers: President, Robert L. Carr; treasurer, Parker Borden; corporation clerk, Henry M. Carragher; directors, Robert L. Carr, Parker Borden, Henry M. Carragher, M. C. Yarwood, Mark Yarwood, George B. Durfee, Robert Nicholson, Samuel Seabury of Tiverton, and W. A. Dolan. The capital is $50,000.

Detroit, Mich.—The Detroit, Norris and Mt. Olivet Railway Company. The road will probably be operated by horse-power at first, but it is intended to use electricity as soon as practicable. The capital stock of the company is $100,000, divided into 4,000 shares of $25 each. The names of the incorporators are: Willliam C. Maybury, O. W. Shipman, William B. Moran, Ralph Phelps, Jr., J. B. Mulliken, N. K. Riddle, James A. Phelps, E. H. Sellars, A. F. Sellars.

Tacoma, W. T.—The Tacoma Railway and Motor Company, by Paul Schulze, D. H. Louderback, James M. Ashton, John H. Cummings, J. H. Mitchell, Jr., Henry Hewitt, Jr., and C. J. Kershaw. The capital stock is placed at $500,000, divided into 5,000 shares of $100 each. The incorporators constitute the board of trustees that shall manage the affairs of the company for the first six months. The purpose of the company, as set forth, is the construction and operation of street and suburban railroads.

ELECTRICAL REVIEW

Published at 13 Park Row
P. O. BOX 3329.

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REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.
TELEPHONE CALL, 546 JOHN.

Timothy W. Sprague, 192 Summer Street, is our representative at Boston, Mass.
Mr. C. C. Haskins, City Hall, Chicago, Ill., represents the REVIEW in the West.
George C. Maynard, 1419 New York Ave., Washington, D. C.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries $5.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT

Address all communications and make all Express Money orders, P. O. orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, JUNE 22, 1889.

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DEATH OF WILLIAM F. SWIFT.

It is with feelings of sincere regret that we announce the death at Cleveland last week of Mr. William F. Swift, secretary of the Brush Electric Company. Mr. Swift had been in poor health for some time, and it was on this account that he gave up the active management of the New York office some time since; but no immediate danger was apprehended, and his departure was entirely unexpected. Mr. Swift was one of the best known men in the electrical field, starting in it at the outset when the Brush Company was formed, as its secretary, in which position he has served continuously. Previous to his entrance into the electrical business Mr. Swift had already won a reputation in the literary field. By his death not only the Brush Company, but all electrical interests lose a painstaking and successful worker and an esteemed and honorable man.

The Massachusetts legislature touches the matter of electrical executions gingerly, leaving all avenues open for the continuance of the present method of inflicting the death penalty and in no way binding the State to give electricity a trial even.

Last Friday some 350 guests, including many electrical celebrities, banqueted in Paris, and General Franklin, the American commissioner to the Paris Exposition, presided in his well known graceful manner. Paris seems to be the electricians' Mecca just now. It is usually said that all good Americans go to Paris when they die. This year they will go to Paris without waiting to die.

Through the efforts of the Gas Commission the bids of the six competing electric light companies in this city have been thrown out on the accusation of a "combine" having been formed. Strange people, these gas men, anyway. Who ever heard of a combine between rival gas companies, to keep up local prices. Please do not all speak at once.

The subway from Chatham Square to the Harlem river via the Bowery and Third avenue—a distance of about eight miles—which it is proposed to lay in the immediate future, will call for so large an investment of capital with so small an assurance of profit, that it may be well said of the investors that they possess the orthodox quality of faith which is defined as "the belief in things unseen, the evidence of things unknown."

We wish to call attention to the letter of the Secretary of the National Electric Light Association, published in another column. In it Mr. A. V. Garratt has again given full particulars of the arrangements completed for the next meeting of the Association at Niagara Falls in August. As will be seen, the comfort of not only the members will be looked after, but also everything done to make the trip pleasant for the wives of the delegates who it is hoped will attend this convention in force.

Professor Elisha Gray remarks that electrical science has made a greater advance in the last 20 years than in all the 600 historic years preceding. More is discovered in one day now than in a thousand years of the middle ages. We find all sorts of work for electricity to do. We make it carry our messages, drive our engine, ring our door bell and scare the burglar; we take it as a medicine, light our gas with it, see by it, hear from it, talk with it, and now we are beginning to teach it to write.

Mayor Grant of this city wants District Attorney Fellows to give him full information as to the proceedings on the complaint made against the electric light companies who erected poles and strung wires without permission. The district attorney has sent his excellency word that he can't tell him that, but he can tell him most anything else he wants to know. We are of the opinion that this is not the only fact about pole cutting as a pastime, in regard to which his Honor will have difficulty in getting the information he wants.

VENTILATING THE CONDUITS.

A step in the right direction has been taken in the attempts now being made under the direction of the engineer of the Board of Electrical Control, to properly ventilate the electric subways. A large blower has been placed in the basement of the Hotel Metropole, at Forty-second street and Broadway, and connections made with the subways. A constant current of air is sent down along the line, and at Fourteenth street a pipe runs out of the man-hole to the roof of one of the houses. It is stated that the system will be applied in other places, and that all danger of man-hole explosions is now over. Some fault is however already found in this method as it is claimed by householders along the line that the air pressure is so great in the conduit that connections are forced open and gas sent into neighboring cellars. A suggestion is made, that the blowers be placed at the outlets and the gas sucked out rather than forced through. The tendency in this case would be to help ventilate cellars and basements situated near leaky connections, and possibly the end in view would be defeated and the conduit contain more gas than before.

ELECTRIC CLUB MEETING.

It is anticipated that on Thursday evening June 20th, an unusually large audience will gather at the Electric Club to listen to Prof. Robert Spice, who will be the lecturer of the evening and will address the Club on the subject of "Exact Ways of Determining Pitch." The lecture will be fully illustrated by interesting experiments of a novel character in this most interesting branch of physical research. Those of the members and their friends who had the pleasure of attending the last lecture delivered at the Club by this gentleman will remember with interest his brilliant experiments on the "Properties of Light." It is believed that next Thursday evening has in store for those who are fortunate enough to be present even a greater treat.

WET WEATHER WORK.

At no time since the starting of the movement to put wires underground has such remarkable activity been displayed as at present. On nearly every New York street in which subways have been laid may be seen large reels of cable and gangs of men at work drawing cables into the ducts. Down in the manholes the splicers are at work in a heated, foul smelling atmosphere, in which even with a powerful air blast from the surface, it is only possible to work for a few hours at a time. On rainy days the work of splicing has to be suspended, as a very costly experience has shown that joints made in wet weather are unreliable on account of the lowering of the insulation due to the absorption of moisture. Although no splicing is now done in wet weather the cable splicers must be paid during such times. Cable companies have found that electric plumbers are not numerous, and to keep them they must be paid rain or shine.

This adds greatly to the cost of underground work where much splicing is to be done, and has wiped out the profit on more than one job. The rules of the company controlling the subways do not prevent the placing of a tent or house over a manhole on account of its interference with ventilation. This has been done however in other cities and it would seem that some arrangement might be devised for New York, which would keep out the rain, and at the same time afford sufficient ventilation.

ELECTRICAL EXECUTIONS.

No one subject, with the exception of the Johnstown calamity, has secured so much space and prominence in the daily press during the past week or two as the execution by electricity, or postponement of execution of the convicted murderer Kemmler, of Buffalo. The entire country seems aroused on the subject, and the number of instances coming to light daily of those who have come out unscathed from contact with high tension current, both direct and alternating, cannot fail of effect in influencing the popular mind to counsel the utmost deliberation before the attempt is made to so wrongfully pervert the functions of this wonderful fluid. The assertion made that the strenuous efforts of the convict's lawyers to effect a stay of proceedings were instigated by the electric manufacturing companies is refuted by no less an authority than the lawyers themselves, and yet were the assertion true it could hardly be wondered at, for who in the electrical business, or in any way connected therewith, but feels a shudder at the thought of such an abasement of the high and lofty science in the study of which and application to the most useful service of mankind he is giving his life and energies; and who in any line of scientific investigation and research but would feel his faculties benumbed and efforts blunted by the thought that the product of his toil was to be applied to an attempt at the extinction of that divine something, the spark of life. With these thoughts in mind the conduct of one individual, who while claiming to be an electrical expert and winning his daily bread by electrical pursuits, at the same time is using every effort to bring about this abortive use of the electric current and leaving no stone unturned to prejudice the popular mind against it, is, to say the least, enigmatical.

Were all efforts turned in a direction of legitimate progress and development, how much better for everyone concerned.

SECURITY AGAINST DISTURBANCE OF SHIPS' COMPASSES.

"THE EFFECT OF ELECTRIC LIGHT APPARATUS ON SHIPS' COMPASSES."

As might be expected the use of electricity on shipboard for lighting and running motors is not without its effect on the ship's compass. In some cases an error of five degrees has been caused. The needle is affected by induction from the current flowing in the wires and by the magnetism of the dynamo itself. We have not heard of any disturbance arising from electric motors, but this may be owing to the limited extent to which they are used, as an electric motor is in its effect on the compass the equivalent of a dynamo. The one wire system which is not used in this country seems to be responsible for many of the compass troubles thus far reported. In this system the iron hull of the ship is used as a return conductor to the dynamo, and a deflection of the needle is the natural result. Obviously the employment of symmetrically placed outgoing and return wires well insulated, will prove a complete remedy for disturbances arising from the conductors. There then remains but the induction from the dynamo and motors which can be overcome by judicious arrangements. We publish in this issue a paper by Sir William Thomson on this subject, which is worthy of a careful study by everyone who is interested in marine electric installations. One interesting point brought out in this paper is, that the wires or dynamos of the alternating system are without effect on the compass, whether the single or the double wire plan of wiring be used.

The marine chronometer, as well as the compass, is adversely affected by the careless and unscientific placing of electric light apparatus on shipboard. The variations produced in ships' chronometers by magnetism was fully explained in a paper before the Electric Club by Lieut. Toppan, U.S.N., who recommends the use of a non-magnetic chronometer which would operate independently of any magnetic strain to which it might be subjected. There is no doubt that an electric light plant can be installed on a steamship without detriment to its navigating apparatus; it might be the part of wisdom for all vessels to carry a non-magnetic chronometer.

A FUTURE INDUSTRY.

The future possibilities of electricity, as applied to locomotive purposes makes one fairly dazed with the impossibility of grasping the subject. Much has been said and written in regard to the application of electric power to street railways for the transportation of passengers, and this especial branch of electric power has already developed into a great industry, the size of which is appreciated by few. The application of electric power to the transportation of merchandise in our great cities is as yet a *terra incognita*, though its possibilities are even greater than the street railway service. An electric street car can, under skillful management, be operated cheaper than one drawn by horses. It requires three times the power to propel a vehicle over a stone pavement than on a rail or iron roadway. Horses cannot draw heavy loads on iron roadways because of the difficulty of obtaining a sure footing. On an iron roadway an electric locomotive can draw a load for less money than horses could draw the same load on the best stone pavement. The expenditure for cartage in the city of New York each year reaches the enormous sum of $100,000,000.

At some future day, not far distant we hope, when the public are sufficiently aroused to the importance of this question, a certain width of our great thoroughfares all over the city will be given up to an iron roadway on which self-propelled electric vans may noiselessly carry on the great traffic which now offends our ears, wears out horse flesh, and has been but little improved up to the present day since the days of the Cæsars. In fact we aver that with our boasted improvements of the nineteenth century it requires more expenditure of horse-power to draw a ton of merchandise a mile in the streets of New York than it did in Rome in the early days of the Empire.

LATEST ELECTRICAL NEWS FROM ALL POINTS.

OUR CHICAGO LETTER.

Gaston Plante.—The inventor of the storage, the secondary, or the accumulator battery, is no more of earth. He died recently at his residence "Bellevue," near Sèvres, France, at the age of 55 years. Mr. Plante was one seldom equalled for combined, modest, worthy inventive ability, and ingenuousness of purpose. He looked far above and beyond present momentary gain, and sought only to aid progress in the world's development. He was kind, generous, ready to assist the needy, and gave freely and without recompense of the knowledge he possessed to all. His discovery of the accumulator battery, in 1859, which was thrown into the public use, and became the property of the world; "for," as he told the writer, "it would thus sooner become a matter of value to the public than if it were controlled by a patent." His first noted achievement was the discovery, while student, of a new fossil, the *Gastornix*, which won for him high collegiate distinction. For his distinguished scientific successes, and the active part he had taken in the several national expositions, he was made chevalier and subsequently officer of the Legion of Honor. His last act was proof, if that could be necessary, of the love he bore to his fellowman. The property at Bellevue is to be converted into a home for poor scientists; and in addition to this provision of his will, he instituted a prize of 3,000 francs to be awarded every other year for the discovery of some new fact, or property of electricity. And yet what less could be looked for from one who was ever ready with his purse as with his mind and hand to assist the unfortunate or needy scientists, and especially those of the electrical fraternity.

Wire Fire.—The Board of Trade people were badly worked up on Wednesday evening about five o'clock, all on account of a peculiarly scented smoke which came up from the basement. The policemen on the corners didn't think that it would amount to much, inasmuch as the building is fireproof, and so were in no haste to turn in an alarm. But like burning dog-leg tobacco the more it smoked the worse it smelled, and an alarm was finally turned in. Now if there ever was a sad hole for a fireman to get into, it is the under part of the Board of Trade building—and that was full of smoke. But the fire worshippers got there, and put out a fearfully tangled burning mass of insulated telegraph wires, belonging to one of the companies here. Of course the electric light wires were in danger of being accused, but fortunately they were in another part of the cellar. The cause of the fire is somewhat of mystery, but, whatever it may have been, the electric light people are clearly out of the case.

Correction.—In my list of electrical committeemen on account of Johnstown sufferers, I inadvertantly omitted the name of Geo. A. McKinlock, and he is too good a fellow to be left out in the cold, and since among other contributions must be mentioned, T. W. Wilmarth, $25.00.

A Novelty.—The latest novelty in which electricity plays a part is one of the put-your-money-in-the-slot-and-see-it-go style. It is higher priced than its predecessors, but you get more for your money. This one costs a quarter. You put yourself in a satisfactory position, cook up a proper smile, look steadily at a spot designated, drop in your two shilling piece, wait about five minutes and a snap shot photograph comes out complete. In military parlance, the whole is done in one time and two motions. The machine can't make any change, but you can make it give you two pictures for one price if you and your girl are sufficiently well acquainted to stand very close together when the quarter goes down the slide.

On the Rise.—Central Union Telephone stock climbed up the scale this week until sales were made at 60, and 65 is now asked. The Central Union pays six per cent., which, at a cost of 65, is pretty good interest, taking into consideration the fact that it is paid quarterly, it comes well up to ten per cent. on the investment.

Poles Making Trouble.—Cheboygan, Michigan, is down on the pole nuisance, and the telegraph company has been ordered to remove the obstructions within 30 days. No evidence of compliance with the order being apparent, the city government will order them—"New Yorked," I think they call it, unless there is immediate evidence of submission to the order.

Street Work.—Chicago is so well underrun with wires that more or less annoyance is occasioned by workmen opening manholes in business streets to place or change wires in the conduits. To remedy this trouble, an order has been issued by Commissioner Purdy, that all such work shall be done between 7 P.M. and 8 A.M., when the streets have been comparatively deserted. C. C. H.

Chicago, June 15, 1889.

OUR DOMINION LETTER.

To the Editor of Electrical Review:

The electrical atmosphere in Canada is becoming surcharged with electrical schemes as well as legitimate enterprises.

The latest fad that has struck Toronto is the dry battery. The manufacturer claims everything for it of course. The main feature claimed for this wonderful (?) invention is that it will last forever. Useless it is to tell those who believe as he does, that only a given amount of energy can be obtained by the consumption of a given amount of chemicals, though they know no more about it than the maker himself, and that is apparently very little. A primary battery scheme was inaugurated here some years ago and enough innocents were entrapped in the net to nicely line the promotor's pockets. One still hears an echo of the bewailing of the innocent ones. Within a month a primary battery scheme with a long name was offered to a confiding public but met little encouragement here apparently for the place is vacant, the bird is flown.

The City Council, who have been all winter wrangling over the underground scheme, awaiting the decision of which have been the several electric light companies, have just given permission to the Edison company and the Toronto company, as well as the Bell Telephone Company, to lay down underground systems to suit the several companies Work will begin at once.

Some time ago a dispute arose between the stockholders of the Montreal Telegraph Company and the Northwest Telegraph Company, as to whether the Northwest Company could be compelled to pay eight per cent. on the Montreal company's stock, the Northwest Company having leased the Montreal Company's lines under a guarantee to pay eight per cent. There was a proviso, however, allowing the Northwest Company to let their contract lapse, by a 30 day's evasion of dividend. It seems the Western Union Company were guarantees of the Northwest Company, and the Montreal Company claim the Western Union Company are bound to carry out the agreement of the Northwest Company. The Northwest Company, however, think differently and have allowed their lease to lapse, and have, in lieu of the regular eight per cent., tendered the Montreal company six per cent., which they feel is a just rental; just, because when the contract was made between the companies, competition was not in the field. Since then the Canadian Pacific Company have come as a strong competitor, and have divided the profits with the Northwest Company.

The suit now on between the companies may eventually result in the acceptance of the six per cent. or an open fight. As an evidence of this, Chas. A. Tinker, of New York, and others, have applied for a charter to enable them to do a telegraph business in Canada.

The new telephone company at Montreal, the Federal Telephone Company, are organized and in running shape. They use metallic circuits. Law system, and give a very quiet service. They have a large list. In consequence of the competition the Bell list has grown to over 3,000, though a primary cause was the reduction to 25 cents per year, or ten dollars below the Federal Company's price.

Mr. Eugene Phillips, who supplied the Federal Company their cable, has been wise enough to see a future for his business in Canada, and has opened a factory at Montreal, in which he proposes to make a full line of goods. The Hibbard Electric and Manufacturing Company, of Montreal, are the only other concern in Canada doing a manufacturing business. They have gone into their new factory, in which a novelty for Canada is introduced. Every floor is to have on electric motor as motive power, supplied from the engine room on the premises.

Among the new concerns in Canada may be mentioned that of Hy. S. Thornberry & Co., of Toronto, electrical engineers, who start with a very fair showing, having obtained two large contracts for electric light work, namely: the new Board of Trade building and the new Canadian Bank of Commerce building, both representative buildings. They have besides several smaller contracts.

The Toronto Electric Light Co. are preparing to place the additional lights called for by the city, which will give the city between 300 and 400 arc lights.

The Royal Electric Co., of Montreal, are also preparing to add the 600 arc lights to their system, for which they have a contract with the city of Montreal with two years to run.

The Ball Electric Light Co. are located at Toronto and are doing a good business. They report as recent sales, 400 lights in the Gooderham Distillery, Toronto; 350 lights in the hospital for insane at Mimico, Ont., and 75 arcs at Victoria, B. C., 40 arcs additional at Bellevill, Ont.

The Royal Electric Co., of Montreal, report the following: 600 alternating system lights, to the Moncton, N. B., Gas and Water Co.; 200 lights incandescent for Hiram Walker's residence, Pechese Island, Ont., and 1,000 lights alternating to the Manitoba Electric and Gas Light Co., Winnipeg, Manitoba.

The Westinghouse Co. have sold a 500 light plant to the Hamilton, Ont., Electric Light Co. The have also wired the new City Hall at Hamilton.

"Canadian."

Toronto, 18th June, '89.

Headquarters of the National Electric Light Association, 18 Cortlandt Street, Room 512.

New York, June 15, 1889.

Gentlemen: For the accommodation of those attending the next convention of this Association, which will be held at Niagara Falls, August 6, 7 and 8, a special, limited, vestibule Pullman train will leave Jersey City, *via* the Lehigh Valley R. R., as the second section of the 8 o'clock A.M., limited ("Comet"), Monday, August 5.

This train will consist not only of several Pullman parlor cars, but also dining cars and an observation or composite car, as may hereafter be determined. It will be in every respect equal, if not superior, to the famous electric light train between New York and Chicago last February.

As there is no road in the Trunk Association between Boston and Niagara Falls, and as especially low rates have been obtained between New York and Niagara Falls, Boston delegates can travel as cheaply by this train as to go direct.

Parties from New England can leave Boston *via* Fall River Line, Sunday night, Aug. 4, at 7 o'clock, and will be transferred from the boat in New York, on the annex, directly to the train at Jersey City, where they will find breakfast awaiting them.

Delegates from Washington, Baltimore and Philadelphia can connect with this train at Bethlehem, at 10.40 A. M., by leaving Philadelphia (9th and Green street station), at 9 A. M., Monday, Aug. 5.

From considerable inquiry it is found that many of the members propose taking their wives and lady friends to the Niagara Falls Convention, and a special car will be provided for their accommodation and everything possible will be done to insure their comfort.

In order to insure the successful operation of this train, it will be necessary for all interested parties to correspond with the Association at its headquarters 18 Cortlandt street, New York, at the earliest possible moment. Blanks and forms are now ready for distribution and seats can be assigned immediately. Mr. T. C. Klase, passenger agent of the Lehigh Valley R. R. may be found at the association headquarters every forenoon, and will gladly furnish all needed information, and will at once issue Pullman certificates for this train. Col. C. M. Ransom, 146 Franklin street, Boston, will issue Pullman certificates to such of the New England delegates as find it more convenient to see or correspond with him.

This train will be lighted throughout by electricity, and will be the largest train ever run exclusively for electrical people.

Yours very respectfully,

Allan V. Garratt,
Secretary and Treasurer.

PERSONAL.

A special meeting of Bell telephone stockholders is called for September 12th. The directors recommend the issue of $2,500,000 new stock, one-half in October and one-half in April, 1890.

Mr. J. I. White, secretary of the Bass Foundry and Machine Works, of Fort Wayne, Ind., paid New York a visit last week, and during his stay entertained his friends very handsomely at the Electric Club.

In the U. S. Court at Indianapolis a bill in chancery against the Evansville Gas and Electric Light Company, operating the Westinghouse system of incandescent lighting, has been filed by the Fort Wayne Jenney Electric Light Company.

Justice Andrews, of the Supreme Court, Monday appointed Francis D. Dowley receiver of the property of the West Side Electric Light and Power Company, of New York, in a proceeding taken by the trustees for a voluntary dissolution of the corporation.

Harry F. Lincoln, son of Dr. A. R. Lincoln, of Dennysville, Me., sailed from New York Saturday, for Cardenas, Cuba, where he will assist in establishing an electric light plant. Mr. Lincoln is a graduate of the Maine State College and is now in the employ of the Thomson-Houston International Electric Company.

The trustees of the Polytechnic Institute, at Worcester, Mass., have voted to establish a course in electrical engineering. It will practically be a post graduate course, being open to graduates of the mechanical engineering department and others of equal attainments. Prof. A. S. Kimball will be the professor in charge, and the new course will be opened in the fall.

The second anniversary of the Boston Electric Club will be celebrated at the Club's pleasant rooms on Park street on Friday evening, June 21st. It is announced that a collation will be served and an entertainment of a musical and kindred nature will be provided. While not as elaborate as the memorable celebration a year ago, it is intended to make the commemoration of the second anniversary an enjoyable occasion.

Among the officers of the Baltimore and Ohio railroad, who deserves especial mention for his work during the last week is Charles Selden, general superintendent of telegraph. He left on Sunday morning with Vice-President King and General Manager Odell, and went over the road to repair the damage to the telegraph wires. He worked night and day, and even strung wires and helped raise poles himself so that one wire at least could be had to facilitate the railroad work of repair, for without telegraph communication along the road this was utterly impossible. From Sunday until Wednesday night he worked day and night and never went to bed until Wednesday, when he reached Cumberland, having repaired the lines through.

The A B C of Electricity.

"The A B C of Electricity" is the title of an attractive little book which, as its name indicates, is intended for beginners, young or old, in the field of electrical study. The author of the book is Mr. William H. Meadowcroft, of New York. The author states in his preface that the book is not put forward as a scientific work, but is intended to supply desired information to those in the elementary stages of electrical learning, as well as to those who desire a general outline of the science and groundwork of those electrical inventions which are to-day of such vast commercial importance, and this without requiring a research into books treating more deeply of the subject. The book contains definitions of the more familiar electrical terms, simple illustrations and water analogies being used wherever possible to make the meaning clearer, and the various commercial uses of electricity each receive a due share of attention. The book is well illustrated and no pains have been spared to make it accurate and reliable throughout. A large number of readers will, no doubt, receive their first book knowledge of electricity through this medium and others further advanced may obtain many useful hints. ["The A B C of Electricity," by William H. Meadowcroft. New York, 1889. Frank F. Lovell & Company.]

Telephonic News

*** During a recent thunder storm at Keene, N. H., 57 telephones were burned out.

*** The telephone system at Chattanooga, Tenn., is being entirely reconstructed, and a satisfactory service seems now assured.

*** Twenty-seven telephone poles were shattered by lightning within two miles of Contoocook, N. H., during a storm last week.

*** The Bell Telephone Company in Detroit is said to have 500 miles of line underground in the Dorset conduits working well.

*** The New England Telephone and Telegraph Company has just commenced erecting a line of poles from Fitchburgh, Mass., to Gardner. It is intended to extend the line to Greenfield, later in the season.

*** The telephone exchange at Auburn, Me., suffered severely from recent storms, and more damage was prevented by the prompt and courageous action of Supt. Stanford, who stayed in the station as long as he dared putting in new protectors, which were almost immediately burned out again.

*** The London *Medical Press* says there is talk of applying telephones to the infectious wards of the French hospitals, so as to enable the sick people isolated in their contagious sufferings to have the comfort of hearing their relatives' voices without any risk of conveying infection by an interview.

*** At a recent meeting of the Fire Department Committee, of San Francisco, Chairman Barry reported that he had arranged with the Pacific Bell Telephone Company to put 21 telephones in the engine houses of the Fire Department for which the city will be charged $5 per month each. No charge will be made for switches, provided the telephones are used only for public business.

*** The electric storms seem thus early to have been especially severe on the telephone service. The Bangor, Me., *Commercial* of recent date says: "In the electrical storm of yesterday morning more telephones were disabled than in any storm which ever occurred in this city. Superintendent Collamore said this noon that his force had the repairs fully made but wanted to see no more storms of that sort. Instruments all over the city were melted out, but the west side suffered particularly."

*** The telephone bell rang suddenly in the Elysee the other day, says the Chicago *Herald*, just as President Carnot and the Cabinet ministers were assembling in council. An official put his ear to the tube and heard an unknown person ask if he were in communication with the Elysee, as if he had an important declaration to make. Upon being answered in the affirmative, the unknown applied his mouth to the telephone and delivered the following message verbatim: "Vive Boulanger! You are all a pack of robbers!"

*** At annual meeting of the stockholders of the Erie Telegraph and Telephone Co., held at Hotel Normandie, New York, on Tuesday, the following named were elected directors: Levi Sprague, Charles J. Glidden, Chas. E. Adams, Francis Jewett, A. C. Russell, J. W. C. Pickering, Abner S. Adams, of Lowell, Mass.; Wesley A. Gove, of East Boston; James A. Weston, of Manchester, N. H.; H. A. Whiting, of Wilton, N. H., and W. J. McKinnie, of Cleveland, Ohio. Mr. Abner S. Adams, the new director succeeding James W. Bennett, has been the largest stockholder outside of the board. At Erie telephone meeting 35,000 shares out of 48,000 were represented. Report was adopted.

Better Telephonic Communication.

The insurance and shipping men of Boston are moving in the matter of completing the telephonic connections between the life saving stations along the coast and are now working to secure a connection between the Monomoy and Chatham life saving stations. To this end a petition has been framed and largely signed, which will be forwarded very soon to Hon. S. I. Kimball, general superintendent U. S. life saving service. The petition is signed by the representatives of the leading marine insurance companies, a large number of captains and by the directors of the chamber of commerce. The latter have also adopted resolutions in the matter and have received a favorable reply from the authorities at Washington. The petition is as follows: The undersigned, believing it to be for the interest of humanity to make use of all the advantages of modern science in the work of rescuing life in case of disaster on our coasts, respectfully recommend to your consideration the matter of connection by telephone of the Monomoy and Chatham life saving stations with the telegraph system at Chatham, Mass., at which point, which is peculiarly well situated for observation, the operator on duty has been in the practice of reporting to parties interested, such casualties as may be within his knowledge; the improvement we wish to bring to your notice will extend the field of observation, and, in many cases, may be the means of obtaining, and to vessels in distress possibly preventing, the risk of lives of the men in your department as well as the shipwrecked.

The Universal Electrical Exhibition to be Given in the Fall.

Among the many attractions of great interest in store for visitors to the St. Louis Exposition next fall will be a "universal electrical exhibition," beginning September 4th, and continuing for a period of six weeks. The directors of the Exposition Association, in common with many other influential gentlemen, are now making arrangements for the display, of which David J. Harris, who has an office on the second floor of the Laclede building, is manager. Circulars issued to the electrical fraternity announce that ample accommodations will be reserved and no charges will be made for either power required or space occupied by exhibitors whose application shall have been received and accepted previous to July 15th, 1889. Applications for 65 different exhibits are already on file, and arrangements are pending whereby freight charges will be one-half the usual rates. There have been reserved and set apart 75,000 square feet of space for electrical exhibits. Arrangements have been made for cheap excursion rates over all railroads running into St. Louis. It is estimated that at least 700,000 people will visit the exhibition. It may be added that Gilmore's celebrated band has been secured by the directors to furnish music during the entire six weeks of the Exposition.

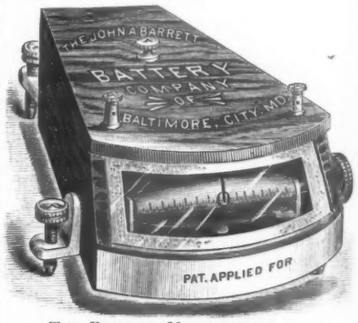
The responses received to circulars sent out, it is claimed, are already very flattering, applications for space having been sent in by the following companies: The Sperry Electric Mining Machine Co., No. 175 Dearborn street, Chicago; Western Electric Co., 227-257 Clinton street, Chicago; Missouri Phonograph Co., St. Louis; Perkins Electric Lamp Co., St. Louis; Electro Dynamic Co., Philadelphia; Heisler Electric Light Co., No. 809 South Seventh street, St. Louis; Electrical Accumulation and Lighting Co., St. Louis; Automatic Switch Co., No. 8 Keyser building, Baltimore, Md.; American Waltham Watch Co., Waltham, Mass.; George Cutter, No. 80 Adams street, Chicago; Simplex Electrical Co., No. 620 Atlantic Avenue, Boston; Central Electric Co., Chicago; the William Powell Co., No. 54 Plum street, Cincinnati; the Standard Paint Co., No. 59 Maiden Lane, New York; Buckeye Engine Co., Salem, O.; Hillclutch Works, Cleveland, O.; the Butler Hard Rubber Co., No. 33 Mercer street, New York; American Electric Register Co., No. 620 Atlantic avenue, Boston; Imle E. Storey, Essex building, Denver, Colo.; Bishop Gutta Percha Co., No. 422 East Twenty-fifth street, N. Y.; Porter Electric Construction Co., St. Louis; Schultz Belting Co., St. Louis; Southern Electrical Supply Co., No. 310 North Third street, St. Louis; Findlay Glass and Carbon Co., No. 403 North Eighth street, St. Louis; the St. Louis Electrical Co., St. Louis; James Noble, Nos. 208-210 Vine street, St. Louis; St. Louis Battery Manufacturing Co., No. 807 Locust street, St. Louis; Thomas J. Connor, No. 714 North Main street, St. Louis; C. H. Holmes & Co., Commercial building, St. Louis; Pond Engineering Co., St. Louis; J. G. Smith, St. Louis; Julian Morisse, St. Louis; John A. Roebling's Sons & Co., Chicago; O. Godefrey, St. Louis; Parrish Bros. & Peck, St. Louis; John Stevenson Co., limited, No. 47 East Twenty-seventh street, New York; Detroit Electrical Works, Detroit, Mich.; the Woodhouse & Rawson Electric Supply Co., of Great Britain (Ld.), 11 Queen Victoria street, London; the Schuyler Electric Co., Middletown, Conn.; Elgin Telephone and Electrical Supply Co., Dawson, Ga.; C. McIntire & Co., Nos. 431 Washington and 36 Crawford streets, Newark, N. J.; American Watch Tool Co., Waltham, Mass.; Janney & Wickersham, corner York and Walnut streets, Pottstown, Pa.; F. M. Sparrow, office 141 Milk street, Boston; Friction Pulley Co., Sandy Hill, N. Y.; Jarvis B. Edson, Nos. 145 Broadway and 86 Liberty streets, New York; the National Carbon Co., Cleveland, O.; Hanson, Van Winkle & Co., No. 219 Market street, Newark, N. J.; American Silk Manufacturing Co., Nos. 2109-11 Market street, St. Louis; Union Porcelain Works, Green Point, N. Y.; Union Hardware Co., Torrington, Conn.; the Electrical Accumulator Co., No. 44 Broadway, N. Y.; Pacific Electrical Storage Co., No. 220 Sutter street, San Francisco, Cal.; J. Ned Harrison, Bradford Club, London, England; E. & A. Shaw, No. 411 Fourth street, Sioux City, Ia.; the West Side Electric Light and Power Co., No. 502 West Fifty-third street, New York; the Okonite Co., No. 13 Park Row, New York; the Mayflower Mine, Benj. B. Lawrence, Idaho Springs, Colo.; Writing Telegraph Co., office 57 Murray street, New York; J. H. Bunnell & Co., Nos. 106-8 Liberty street New York; Chas. A. Schieren & Co., Nos. 45 and 51 Ferry street, New York.

*** The Montclair, N.J., Township Committee at its last meeting had a long discussion on the subject of lighting the town by electricity. Chairman Ward, of the Bloomfield committee, was present at the invitation of the Montclair committee, which desired to effect a combination to introduce electric lights into both towns. It was finally decided to advertise for bids.

*** There are three divisions to the territory covered by the telephone exchange operations of the Erie Company. The contracts with the Bell Company for these divisions expire as follows: The Cleveland contract expires September 30th, 1889; Southwestern, June 1st, 1891; and the Northwestern contract is perpetual. It is thought that the American Bell may grant the Erie perpetual contracts for the Cleveland and Southwestern divisions upon the same basis as the Northwestern. Upon this basis the earnings of the Erie Company, based upon the earnings for the quarter ending March 31st, 1889, would show upon the capital stock as follows (not allowing for any increase on account of new business): For the year 1889, 4½ per cent.; for the year 1890, after deducting American Bell Company's proportion, $3\frac{63}{100}$ per cent.; 1891 and thereafter, $3\frac{15}{100}$ per cent. The quarter ending March, 1889, shows an increase in net earnings above all expenses of $4,000 over the previous quarter, and the net earnings for the past two years show an average increase of $2,200 per quarter. Some estimates would place the increase at the rate of $3,000 per quarter in the future, or $12,000 per year. This would make the earnings in 1890, $228,000; in 1891, $240,000.

A New Mil-Am-Meter.

Through a long experience in electro-medical batteries and like apparatus the John A. Barrett Battery Company have recognized what the desirable features of an electric meter are, and in the instrument herewith illustrated these features have been embodied. In an absolute electric meter accuracy is essential. The magnetic needles of the Barrett meter are less than one inch long, while the pointer—made of aluminum for lightness—is four inches long, thus securing an extended indication on the scale for a very slight movement of the needles. Freedom from changes due to changes of time and surroundings is obtained as far as possible by employing a horizontal movement and an astatic system of magnetic needles, controlled by a fixed magnet, which is permanently under the influence of an armature or keeper, for preserving a uniform degree of magnetism. Such a system of needles is free from the influence of the earth's magnetism and is the most constant in its action. The use of a perfectly-pointed steel pivot, working in a concave jewel, as in the best absolute galvanometers, reduces friction to a minimum, and the free parts of instrument are provided against accidental displacement by a simple detail of mechanism so that the magnetic needles cannot get off the pivot, even if shaken wrong-side-up or otherwise roughly used. A simple locking device also provides for lifting the needles from the pivot and holding them fixed for



THE BARRETT MIL-AM-METER.

transportation. Another advantage of this meter lies in the fact that the face is so pitched at the front that it is readable from either a standing or a sitting position.

The perfect meter should have a wide range of measurement. In this meter shunts, switches, plugs, etc., are largely done away with and, by an entirely new and wonderfully simple arrangement, provision has been made for the widest possible compass, together with direct reading scales. Three independent reading scales are stamped at equal distances apart on the three faces of a celluloid roller. One of these scales is marked in five milamperes, divided into halves. The second scale is divided into 25 milampères, and the third scale reads up to 250 milamperes. This roller is placed in the face of the meter, under the end of the pointer, on a shaft which passes through the side of the case, and terminates in a button by which the roller may be turned.

In connection with this roller is a novel device inside the case, by which, when the roller is turned so as to bring any one of the three scales to view under the pointer, the connections within the case are automatically adjusted so to cause the meter to read directly and accurately, according to the scale so exposed to view. By this means the physician is saved the trouble of using multipliers with his scale readings, and has at command three separate scales meeting every desirable case, and each scale reading his measurements directly.

*** The new electric road up Main street, Cincinnati, Ohio, was a heavy sufferer by the terrible Johnstown flood. The Cambria iron works, which were so hopelessly wrecked, had the contract to supply the castings for the new incline plane. The company did not give up hope of getting the iron, as it was all ready to ship. The word came a day or so ago that it was lost in the acres of debris created by the awful catastrophe, and a new contract was necessary.

Information Concerning the Eleventh Census.

The following interesting letter has been received from the superintendent of the census of 1890:

DEPARTMENT OF THE INTERIOR, CENSUS OFFICE, WASHINGTON, D. C., MAY 1st, 1889.—The various medical associations and the medical profession will be glad to learn that Dr. John S. Billings, Surgeon U. S. Army, has consented to take charge of the report on the mortality and vital statistics of the United States as returned by the eleventh census.

As the United States has no system of registration of vital statistics, such as is relied upon by other civilized nations for the purpose of ascertaining the actual movement of population, our census affords the only opportunity of obtaining near an approximate estimate of the birth and death rates of much the larger part of the country, which is entirely unprovided with any satisfactory system of State and municipal registration.

In view of this, the census office, during the month of May this year, will issue to the medical profession throughout the country "Physician's Registers" for the purpose of obtaining more accurate returns of deaths than it is possible for the enumerators to make. It is earnestly hoped that physicians in every part of the country will co-operate with the census office in this important work. The record should be kept from June 1st, 1889, to May 31st, 1890. Nearly 26,000 of these registration books were filled up and returned to the office in 1880, and nearly all of them used for statistical purposes. It is hoped that double this number will be obtained for the eleventh census.

Physicians not receiving registers can obtain them by sending their names and addresses to the census office, and, with the register, an official envelope which requires no stamp will be provided for their return to Washington.

If all medical and surgical practitioners throughout the country will lend their aid, the mortality and vital statistics of the eleventh census will be more comprehensive and complete than they have ever been. Every physician should take a personal pride in having this report as full and accurate as it is possible to make it.

It is hereby promised that all information obtained through this source shall be held strictly confidential.

ROBERT G. PORTER,
Superintendent of Census.

Greeley's Wheatstone Bridge Set.

Up to the present time there has probably been no attempt to make a first class, comprehensive, electrical measurement apparatus with a fibre suspended needle having special view to rapid work and ease of manipulation until the manufacture of the Wheatstone Bridge Set, with fibre suspended needle and revolving galvanometer, which we illustrate in this article. The apparatus is manufactured by the E. S. Greeley & Company, and is styled by them the No. 3 Wheatstone Bridge Set, and had its origin in the suggestions of Mr. C. E. Birdsall, of this city, formerly electrician for the Edison Company, who devised the particular means of suspending and releasing the needle which is found in this set. The delicacy of action secured through the fibre suspension is so great as to obtain a strong deflection through 1.1 megohm with five cells of Leclanche battery. The apparatus can be used without being removed from the case when it is not essential to level it, and when it is necessary to level it, it can be readily lifted out, as shown in the illustration, and leveled up with the screws provided for that purpose. A revolving galvanometer and a variable and removable dampening and directing magnet conduces to the rapidity and the ease with which work is done with the set. The act of closing the case releases automatically the fibre from all tension, and thus avoids much of the risk of rupture in transportation and guards against the neglect to make the release intentionally. The resistance coils are calibrated in a strictly first class manner, and arranged in four rows of ten coils each under the designation of units, tens, hundreds and thousands. There are 10, 100 and 1,000 ohm coils on each arm of the bridge, thus giving an extreme range of measurement from .01 to 1,111,000 ohms. The arrangement of the coils is such that six plugs only are needed in the set, one in each arm of the bridge and one in each row of the coils, making the reading the simplest possible. For example: If A = 100 and B = 10, to obtain a balance it is necessary to plug five in the thousand, 0 in the hundreds, seven in the ten and 2 in the units row; the resistance measured is equal to 507.2, a method that cannot be exceeded in readiness and simplicity. The revolving galvanometer can be so turned as to bring the needle to the zero line without altering the position of the case.

The Sims-Edison Torpedo.

A trial test of the newly improved Sims-Edison electric torpedo was made at Willet's Point on the Long Island Sound, Monday afternoon. Captain Roessler and a number of regular army officers were present. This torpedo is 31 feet long and 24 inches in diameter. It weighs 3,000 pounds. It has a cylindrical hull with conical ends made in four sections united by means of lock joints. The hull, which is submerged, is supported by an indestructible float, which is attached to the hull by upright stanchions. The electric current is carried through a small insulated cable, and its force is directed from the shore.

A new 1,200-volt Edison municipal dynamo, put in by the government at Willet's Point, furnished the power. G. W. Sims, the inventor, conducted the experiment.

In a run of more than 800 feet yesterday the speed made was a fraction more than 21 miles per hour.

Heretofore the highest rate of speed attained was 10.04 miles per hour. The trial was intended to have been over a half-mile course, but the belting of the dynamo on shore broke and stopped the trial. The 30-inch screw on the torpedo made about 900 revolutions a minute.

The trial satisfactorily demonstrated that the desired increase of speed could be safely made without interfering with the steering of the vessel. Another trial will be made.

* * A re-organization of the Blue Valley Street Railway Company, the St. John Street Cable Company, of Kansas City, Mo., will be made in a few days under the name of the East Side Electrical Street Railway Company. The papers for the incorporation of the new company are prepared and will be filed as soon as a few preliminaries have been arranged. It is the intention of the company to purchase from the Metropolitan Street Railway Company the Independence avenue horse car line and to construct an electrical street railway, the route of which will extend half a mile east of the city limits. Mr. Knight, the engineer who will have charge of the construction, during his recent Eastern trip, made an examination of the various electrical railways now in operation, and it was upon his report that it was decided to make the road an electric line instead of a cable. The road will be operated by an overhead wire, and will be of similar construction to the one now in operation at Topeka which is a great success.

Occlusion of Hydrogen by Nickel.

Prof. M. Bellati finds in his experiments that nickel will not absorb dry hydrogen; but when a nickel wire was used as a negative electrode in a water voltameter, and the quantity of gas evolved compared with that from another voltameter with platinum electrodes, and with a third with platinum anode and nickel cathode, it was found that in 200 hours the nickel had absorbed about 100 times its volume of hydrogen. The occluded hydrogen is not given up if the nickel is placed in a bell-jar containing air and sealed with mercury, but the mercury rises owing to oxidation of the metal.

When a long nickel wire, hanging vertically in a tube of acidulated water, served as cathode to a parallel platinum wire, the nickel wire increased by 0.000036 of its initial length, viz: 1.44 m. This is not an effect of temperature, since comparison was made with the platinum wire, which would have expanded about equally under the influence of heat.

The occlusion of hydrogen increases the resistance of the nickel. If the volume of hydrogen at 0° C. and 760 mm. pressure is r times the volume of the nickel, then the increase of resistance at 22.7° can be calculated from the formula,

$$0.001626 + 0.00005739^2\ r.$$

With increasing temperature, the resistance of nickel containing occluded hydrogen seems to alter rather less than ordinary nickel; thus the temperature coefficient of the latter is 0.00371, while that of nickel with 100 times its volume of occluded hydrogen is 0.00369.

Electric Lighting in a Pit.

A novelty in the employment of electricity for lighting purposes is at present to be found at Ansin, Department du Nord, France, in the Enelos pit belonging to the Anzin Mining Company. In the beginning of 1888, owing to the passage into the Enelos pit of a large quantity of water from the Denain pits and from the Anzin torrent, it was found necessary to install a pump underground in order to raise the water to the surface. The amount of work to be done by the pump was such as to necessitate its being placed in a well lighted spot, both for attendance and maintenance. Naked lights were out of the question in consequence of the presence of fire-damp, and it was therefore resolved to have recourse to electricity, there being an ample supply of water-power. The water, the volume of which is estimated at 70,400 gallons every 24 hours, enters the pit at a depth of 340 yards and descends to the bottom—about 65 yards lower—through tubes, the delivery being almost constant. The power of this fall of water was estimated at two effective horse-power, which could always be relied upon, and this was considered to be sufficient for driving a turbine and dynamo for 16 incandescent lamps. Accordingly the Societe Gramme were instructed to lay down the plant, which consists of a No. 6 compound dynamo and turbine. The pump is fixed in a chamber quite close to the bottom of the pit, whilst the dynamo and turbine are placed about 27 yards distant from the chamber. A Deprez voltmeter has been put up in order that the attendant may at any time notice the pressure. There are 12 16 candle-power Swan lamps. The first lights up the dynamo and turbine, the second is placed at the entrance to the chamber already mentioned and the remainder are inside the chamber, which is consequently very brilliantly illuminated. The speed of the turbine is 1,220 revolutions per minute. The dynamo gives a current of 20 amperes at 110 volts. Since the installation was put up last August it has given the greatest satisfaction.

NEW STYLE WHEATSTONE BRIDGE SET.

TELEGRAPHIC

.... A telephone line will shortly be built from Alameda, Cal., to Bay Farm, it is stated, for the purpose mainly of keeping the police informed of the doings thereon.

.... In the Superior Criminal Court, at Boston, William B. Derby, formerly cashier of the Mutual District Messenger Company, pleaded guilty, on advice of his counsel, P. J. Doherty, to three counts of an indictment charging him with embezzling $16,000 from the Western Union Telegraph Company and the Mutual District Messenger Company. He will be sentenced June 19.

.... The lightning burnt 21 wires belonging to the Western Union Company at Portland, Me., on Monday. The key board was split open and at frequent intervals the electricity would run around the room, on the wires, with a report like a pistol shot. The line men would not approach the wires so they had to remain useless until after the storm. Many telephone wires were also destroyed.

.... A decision was rendered by Judge Tuley, of Chicago, Saturday, which vitally interests 2,000 stockholders of the defunct Great Western Telegraph Company, who are scattered about in nearly all the Western States. In effect it gives them an opportunity to show themselves not liable for a fictitious indebtedness of the company by enjoining the receiver, E. R. Bowen, from collecting an assessment of 35 per cent. on stock subscriptions of nearly $3,000,000. Among the stockholders winning the victory are Senator Farwell, D. B. Fisk and Charles M. Henderson.

.... Lord Ripon's vice-royalty, and the jubilee of the Queen's reign, have together been celebrated in India by the institution of a Jubilee Technical Institute, which has just been opened in Bombay by Lord Reay, says the *Electrical Engineer*, London. The subscriptions of these two funds were supplemented, by grants from the government and the corporation of Bombay, and devoted to the founding of a technical institute, and Sir Dinshaw Petit presented a noble building. The formal opening, as mentioned, took place recently, although the institute has, in fact, been open for several months. It already numbers 240 students, and nearly half as many more are waiting nomination.

.... The telephone is being made to serve the cause of religion in the south of England. The South of England Telephone Company has put telephone wires into one of the Congregational churches in Tunbridge Wells, and on a recent Sunday, 16 subscribers were connected with the church. These included doctors and apothecaries, clerks working in various parts of the town, an invalid lady who has been obtaining consolation from the telephone for several months, and some lazy club men, who went into the thing presumably more from a spirit of experiment than devotion. Wires are being laid to Madstone, and soon subscribers living there, in Rochester, in Strood and Chatham, will be able, without leaving their houses, to attend services in Tunbridge Wells.

.... The use of the electric light in the Suez Canal, which has allowed of night passages being made, has probably had some effect in increasing the traffic. The total number of vessels passing through the canal last year was 3,440, with a tonnage of 6,640,832, being 303 in excess of the previous year. The tolls paid amounted to £2,604,088. Of these vessels 2,625 were English. The use of the electric light is greatly on the increase, and one-half of the ships passing through the canal last year used it. The number of ships in January, 1888, which employed the electric light was 85, and there was a gradual increase until the figure reached 176 in December. The result is that instead of 35 to 45 hours being occupied in making the passage it can now be done in about 20 hours.

* * The new electric road will reduce the time one-half between West Troy, N. Y., and Albany.

* * The St. Louis Car Company is at work on an order of electric cars for a St. Joseph street railroad.

* * The first trip of the electric car to Lynn Beach was made Sunday, and cars were run every 15 minutes. Every trip had a good freight of passengers, and the car ran like clock-work.

* * The Newstead Avenue Elevated Electric Railway filed its bond with the city register on the last day of grace, thus securing its franchise, but it is probable that there will be no work done for several months.

* * The electric railway from Rochester, N. Y., to Charlotte, is nearing completion. The work of putting the roof on the power house is nearly done, and the generators will be placed in position this week. It is the intention of the company to have the cars running by June 25th.

* * There is some talk of an electric railway across the Eads Bridge, St. Louis, to replace the omnibus line that is running at present. If a franchise can be obtained from the City of East St. Louis, Ill., so that the cars can be run from the east approach to the center of the town, it is quite probable that it will be built.

* * Patent Commissioner Mitchell, in the case of Green *vs.* Hall *vs.* Siemens *vs.* Field, on a motion by Hall for a review of Patent Commissioner Hall's decision in favor of Field for a patent for an electric railway, has denied the motion and reaffirmed the decision of his predecessor, Commissioner Hall, in favor of Field.

* * The electric railway cars at Bangor, Me., appeared last week with dazzling headlights giving them a decidedly brilliant appearance. The street for some distance ahead of each car is splendidly lighted by the use of these lights and the conductors are aided greatly in detecting the positions of people who are w iting for the cars.

* * An electric railway is now running from Steinway along Bowery Bay, L. I., two miles in length. It is the overhead double trolley system, built by Osterheld & Eickemeyer, of Yonkers. It is intended to have a train of three cars, using about 15 horse-power to each motor car, potential 350 volts. Mr. E. W. Stevenson did the overhead construction for Woodbridge & Turner.

* * There are now in use in the United States more than 5,650 central electric stations for light and power. There are 210,000 arc lights and 2,600,000 incandescent lamps. There were 59 electrical railways in operation in March last, and 86 roads in process of construction. The increase of capital in electrical investments during 1888 was nearly $70,000,000. These are very significant figures, and they point unmistakably to the course of future inventions and discoveries.

* * It is said that an agreement has been made between the Brockton, Mass., Street Railway Company and the East Side Electric Street Railway Company in relation to a location for the latter through Main street, between Ward and Crescent streets. The Brockton Company will agree to build a double track through this section of the street, which will be used in common, the East side to be obliged to pay for electrifying both tracks, and pay toll for each car operated over the road. This question has been in dispute for over a year, and if an agreement is effected it is expected that the work of building the track will begin at once.

Some Recent Improvements in Alternating Current Motors.

Mr. Charles S. Bradley, of Yonkers, N.Y., is an indefatigable worker in the field of electrical improvement, and has brought out many important inventions both in the line of continuous current work as well as in the newer field of alternating current generators and motors.

Two recent patents obtained by him deserve notice. Both are for alternating current electric motors, and may be briefly described as follows:

Figs. 1 and 2 of the accompanying illustrations are respectively transverse and longitudinal sections of the motor, which in this case is driven by means of two independent alternating currents of different phase. The patentee says:

"In dynamo electric machines and electric motors generally it has hitherto been considered essential to successful operation either to have the field magnet positively energized by means of a current or currents circulating in insulated conductors wound upon the field magnets or else to have the field magnets made of steel and permanently magnetized. It has always been generally considered advisable to laminate the pole pieces of the field magnets for the purpose of preventing the generation of the Foucault currents therein. I have discovered, on the contrary, that such currents may serve a useful purpose in the motor or machine, and they may be so concentrated and directed as to form the sole energizing current of the field magnets, and such discovery forms the basis of my present invention.

"The field magnet is constructed of alternate iron and copper bars with copper heads, and this structure is wound with iron wire on the outside. The bars of copper, together with the copper heads, form circuits of very low resistance for the eddying currents which are to be utilized. The armature is a plain Gramme ring with closed winding which at four equidistant points is connected to four conducting rings on the shaft having brushes connecting them to the two independent supply circuits. These circuits supply alternating currents, the current of one being one-quarter of a phase behind the other, and the result is to produce a rotation of the armature so long as the currents are supplied, and are substantially one-quarter phase apart in their time periods, and in producing the rotation of the armature the two consequent poles N and S set up in the armature rotate around in its iron body at a rate exactly corresponding to the speed of the generator. Suppose, now, the speed of the generator, which is of corresponding impulses, is 1,000 revolutions per minute, then the poles N and S will traverse the armature circularly 1,000 times per minute, and we will suppose this motion of the poles N and S to be right-handed, as shown by the arrows at N and S. As they rotate they induce poles in the iron of the field magnet; but these induced poles N^2 S^2 drag behind slightly, and as opposite poles attract, the armature moves in a left-handed direction, as shown by the arrow at A. Meantime the N and S poles in the armature have moved to the right in direction and the motion of armature continues, and if not doing work obviously it will rise in speed until its speed nearly equals that of the generator, and the relative motion of the poles $N S$ and N^2 S^2 becomes so slight as to be practically negligible. Now, if work is put upon the armature (the generator being maintained at constant speed) its speed falls, and while the relative rotation of its N and S poles remains unaltered with respect to the armature body, the absolute rotation with respect to a point in space changes accordingly; or, to put it in figures, suppose the speed of the generator is 1,000 revolutions per minute, then the poles N and S travel 1,000 revolutions per minute relatively to the armature body. If the armature speed were 1,000 revolutions, the poles N and S would stand still with respect to space, *i.e.*, their absolute rotation would be *nil*. If, now, load is added sufficient to drop the speed of the armature to 900 revolutions, obviously the poles N and S, while still travelling 1,000 revolutions per minute relatively to the armature body, will have an absolute rotation, with respect to a point in space, of 1,000−900=100 revolutions. The direction of this absolute rotation is, as indicated by arrows at $N S$, the same as the direction of relative rotation of these poles N and S; but as this absolute rotation of the poles $N S$ is 100 per minute, it necessarily follows that there is a movement of the induced poles N^2 S^2 in the field magnet following the movement of poles N S, and the speed of this movement is 100 per minute, and each section of the mass of the field magnet is in turn the seat of a rotating polar line, and is cut by lines of force.

"Therefore, Foucault currents are set up, and their value depends upon the resistance they meet with. The position of the field poles N^2 S^2 induced by these eddy currents is always behind that of the poles $N S$, the exact position depending upon two things—the load and the resistance in the metal of the field magnet. The greater the load the greater the lag of the poles N^2 S^2, and, on the other hand, the less the resistance offered the eddy currents, the smaller will this lag become in proportion.

"The result of my invention is that the iron pole-pieces and iron winding or body of the field-magnet become highly magnetized without any current being directly taken from the armature-circuit for that purpose, and in this manner the loss in a motor or dynamo as ordinarily constructed, due to the circulation of these Foucault currents, is readily utilized as a factor in the successful operation of the machine."

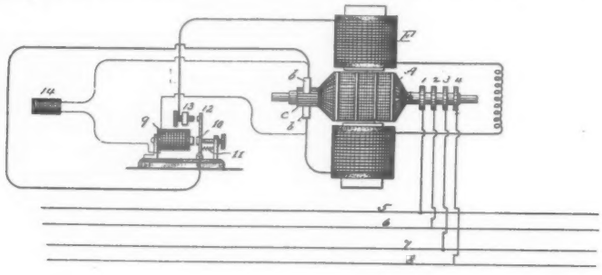


Fig. 3—Bradley's Automatic Field Magnet Switch for Alternating Current Motors.

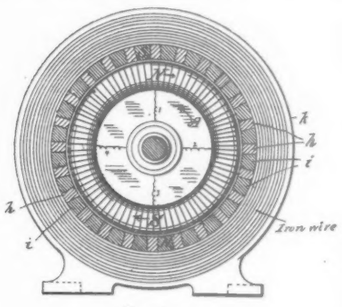


Fig. 1.

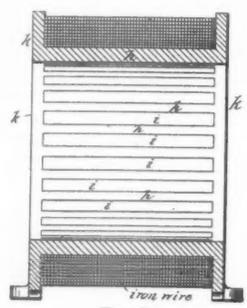


Fig. 2.

Bradley's Induced Field Magnet for Electric Motors.

Figure 3 is a diagram illustrating another invention of great practical value.

Concerning this invention the patentee says:

"In motors of this type it has been found that where the field magnet is directly energized by current flowing through the coils upon it, which seems to be necessary in order to obtain an adequate mechanical output from the motor, it is practically impossible to get the armature up to normal speed if the field magnets are energized at the moment of starting. If the field magnet circuit be left open at the moment of starting the armature by the alternating currents and so continued until the armature has reached its normal speed, the field magnet circuit may then be closed and the full mechanical output obtained from the motor without causing it to fall back in speed, as would be the case were the field magnet circuit closed at the moment of starting. This may be explained in various ways. If we take a given pole of the field magnet and consider that a rotating pole of the armature, which we will suppose an N pole, is approaching the said field magnet pole the latter would become an S pole and strongly attract the said armature pole, and motion of the armature would be produced; but if the field magnet were surrounded with its usual coils closed, the setting up of magnetism in the given field pole would cause an induced current to flow in the coil, which would partially or quite annul the polarity of said S pole of the field magnet. Therefore the result of these two opposing tendencies is that the armature will not start if the field magnet circuit is closed.

"A is the armature of an alternating current motor, and in this particular instance it is shown as a drum armature with continuous winding, from which at four equidistant points connections are made respectively to the insulated contact rings 1, 2, 3 and 4, which are connected by suitable brushes to the respective mains 5, 6, 7 and 8. Mains 5 and 6 supply an alternating current and mains 7 and 8 supply another alternating current which, in this particular instance, differs in phase from the former by one quarter of a wave length. Armature A at the other end is provided with a commutator c and brushes b in the usual manner, for taking off a continuous direct current into any circuit connected with such brushes in accordance with the principles set forth in patent, No. 390,439, dated October 2, 1888. Whenever a current is admitted from the circuits 5, 6, 7 and 8 into the armature A, if the field magnet circuit is open, the armature will immediately start into motion and gradually rise in speed until it substantially synchronizes with the generator supplying currents to the circuits 5, 6, 7 and 8; but if the field magnet circuit is closed the armature will not start and rise to its normal speed. I therefore proceed as follows: I arrange an electro-magnet 9 in a suitable position and place in front of it a pivoted armature 10, having a retractile spring 11, and on the arm which carries the armature 10 I arrange a contact 12.

"In front of such contact I arrange a corresponding contact 13, as shown. The field magnet circuit is closed at all points except the contacts 12 and 13, and my object it to accomplish the closing of these contacts at the moment when the armature A has arrived at its normal speed. The electro-magnet 9 is included in a branch circuit taken from the brushes b, and including by preference a choke-coil 14, which is constructed to have a high coefficient of self-induction and moderate resistance. This, however, is not essential to the performance

of the apparatus. Thus constructed the action is as follows: The armature *A* being at rest, the two alternating currents entering the circuit of the armature cause a rotation of the poles of the latter and set it in motion, and at the same time, by reason of the stationary brushes *b*, an alternating current passes through the branch circuit, including the coils of magnet 9. This single alternating current is due to and corresponds with the rotation of the *N* and *S* poles set up in the armature *A*; but the current is not of such character as to cause the attraction of the armature 10 against the force of spring 11. As the armature rises in speed, the rotation of the poles *N* and *S* of the armature becomes slower and slower, the waves in the branch circuit become longer and longer and straighter and straighter, and the relay hammers slightly on its back-stop until finally, when the speed has reached its normal rate, the current passing through the coils of the magnet 9 is a continuous current in one direction, and the armature 10 is attracted, causing the contacts 12 and 13 to close firmly together and remain there so long as the armature *A* is rotating at its normal speed. It is thus readily seen that the field magnet circuit remains open until the armature has arrived at its normal speed, and at that instant the field magnet circuit is closed and the motor is in condition to exert a maximum mechanical energy."

—— The Oakland, Cal., city engineer has prepared a map showing the proposed location of electric lights. 338 lights of 2,000 c. p. will be erected. The arrangement places 111 single lamps and 35 towers in Oakland west of Lake Merritt, and 19 single lamps and 17 towers in East Oakland. The single lamps will be 50 feet high and the towers 100 feet. The towers will be built like those in Alameda, and will have four lights. C. R. Lloyd estimates that this plan if carried out would cost the city about $50,000 for the poles and wires.

—— The Commercial Electric Company, of Detroit, are to furnish complete steam as well as electric plant for the new theatre and Wonderland, now being built in the Arcade Building, Buffalo. The entire plant will consist of two Mayo incandescent dynamos of 200 lights capacity each and a 40 horse-power automatic, high speed Taylor engine and boiler of the same make. The engine and dynamos which are to be located on the second floor of the building in the exhibition hall are to be very finely finished—a part of the exhibition in fact and a model plant in every respect.

—— The annual meeting of the stockholders of the Woburn Electric Light Company took place Monday at its new office in Boston. The following officers were elected: President, Henry C. Buck; clerk, Benjamin F. Whittemore; treasurer, F. S. Pierson; directors, H. C. Buck, F. S. Pierson, A. E. Dolbear, J. B. McDonald, Dr. J. M. Harlow. It was voted to increase the capital stock from $60,000 to $120,000; also to increase the number of directors from five to nine. This will be done at a special meeting. President Buck made his annual report. It showed the company to be in good condition. The disagreements with the telephone people are about closed up on account of a separate location having been granted for poles and wires. In Stoneham the company has been given right to attach wires to the telephone poles wherever necessary. The fight with the telephone company has cost between $4,000 and $5,000, when the loss of business is considered, in addition to actual expenses. The treasurer's report showed net earnings of about seven per cent., after providing for interest charges.

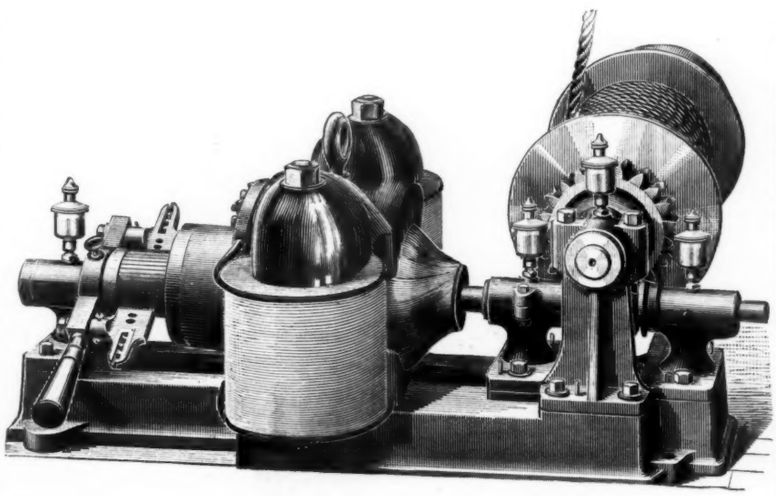
Electric Shell Hoist for War Vessels.

We publish in this issue of our paper a view of one of the electric hoists built by the Sprague Electric Railway and Motor Company, of New York, for the United States cruiser "Atlanta." This hoist is the first of its kind that has been built for this work, and this commencement of the use of electric power on shipboard is most novel, and promises to extend rapidly. The advantages of electric power for the manifold uses on board vessels over transmission of power by steam to different portions of the vessel, are many, and the general adoption of incandescent lighting on shipboard enables such motors to be operated without additional dynamo installation.

The hoist which we illustrate is of three horse-power, using the regular Sprague graphite brushes, and can be run forwards or backwards with the greatest facility, by the simple movement in one direction or another, of an electric switch. By means of this same switch the speed can be varied to any degree desired.

Although built for the special purpose of hoisting shells, this combination promises to to meet a large demand for small hoists in manufacturing and other industries where the small space occupied by an electric motor is quite a desideratum.

The tendency among the leading electric supply companies seems to be gradually towards electric motor combinations with other machines, like the above, and experience shows that such combinations create a demand as their advantages become recognized.



Electric Shell Hoist.

—— The work of testing the new lamps to be used in the Bangor, Me., electric lighting system goes rapidly forward and a great majority of them have been already found to be equal to the tests at the station and will go out on the line. This week will probably see some of the lamps started in different parts of the city and in a short time the entire town will be illuminated. There have been no delays or accidents to the machinery thus far this season

—— Manager Mercein, of the Badger Illuminating Company, Milwaukee, Wis., states that the company's present capacity is being doubled. The company is able to furnish 350 lights at present, and will be able to furnish about 700 lights when the new improvements are completed. The additions to the plant include a 400-horse-power boiler, which is already in place, and an engine of 300-horse-power, which is expected to be ready this week. The improvements, Mr. Mercein estimates, will cost between $150,000 and $175,000.

Circulars and estimates of the cost of an electric motor of sufficient power to run a small printing press are wanted by Edward A. Oldham, of 91 Wentworth street, Charleston, S. C.

—— The City of Wausua, Wis., council has granted a franchise for 20 years to an electric light company composed of the following business men: J. M. Smith, James Montgomery, C. W. Harger and W. C. Collins.

—— The Edison lighting plant on the U. S. cruisers "Charleston" is being put in. It is very elaborate, and cost about $30,000. There are some 500 junction boxes, or 500 places where light can be put in. The light is generated from three of Edison's dynamo machines, making 400 revolutions. Two are driven by engines made by the Union Iron Works, and one by Armington & Sims. They are placed under the two-inch iron deck forward.

—— The New York Central Railroad has made a contract with the Edison Company for putting an electric light plant into the Grand Central Station. It will require 1,400 incandescent lights to supply all the offices, passenger rooms, and the big train shed. No electric lights will be placed in the yards, as they would make the signal lights less distinct; but very soon the tunnel will be strung with incandescent lights, hung on a level with the car windows and lighting up the trains.

—— The Van Depoele Electric Manufacturing Company, of Chicago, Ill., is placing electric light plants upon the following excursion steamers of Chicago: Steamer "Chief Justice Waite," 10 arc lights; steamer "John A. Dix," 150 incandescent lights; steamer "Gordon," 100 incandescent lights; and has also just contracted with the People's Electric Light Company, of Streator, Ill., for a 200-light "Mayo" long distance incandescent series electric light plant to light the outskirts of that city, displacing the gasoline lamps. This makes the plant at Streator consist of 60 arc lights, 1,000 direct system "Mayo" incandescent lights, and 200 long distance incandescent lights. The company is now operating in its new station near the Santa Fe Depot, and claims to have the most complete and best equipped electric light station in America.

—— The Omaha Thomson-Houston Electric Light Company, after a brave struggle, has at last reached that satisfactory stage where it is able to declare a dividend. The affairs of the company are in most excellent shape, and it is now proposed to greatly enlarge and improve the plant. With this object in view the company has purchased ground between Jackson and Leavenworth streets, with a frontage of over 300 feet on Fifth street, on which it proposes to erect a large and substantial power-house, in which will be placed the latest improved machinery. It is proposed to expend $150,000, which, with the $75,000 already expended, will make an investment of $225,000. The company intends to give incandescent lights twenty-four hours a day, and is already making contracts to wire several large buildings.

Electric Light News

—— The arc light system in Manchester, N. H., is being extended.

—— A new electric light company will be organized at Lexington, Ky.

—— The Allegheny Light Company will extend its temporary lighting plants along the Pennsylvania road as far as Altoona.

—— The Belfast City Council will defer making an electric lighting contract until the new company there are ready to enter competition.

—— The Sun Electric Company, of Boston, through the treasurer, Frank Ridlon, has declared a dividend of $1.75 per share, and another dividend is likely to follow.

—— The contract for wiring City Hall, Haverhill, Mass., for the electric lighting was awarded, Saturday night, to Kendall & Slade, an enterprising young firm of Boston, and work will begin at once.

—— At a meeting of the Union Electric Light and Power Company, of Troy, N. Y., it was decided to commence furnishing commercial lighting at once, and to place for inspection exhibition street-lights.

—— Twenty-five thousand dollars worth of stock in the Lyons, N. Y., Electric Light and Power Company has already been subscribed for, and it is expected that the company will be incorporated this week. The capital stock will be $45,000.

—— A charter of the Lebanon Electric Light Company has been filed with the Secretary of State of Tennessee. The incorporators of the latter organization are Sam. Galladay, S. G. Stratton, R. P. McClain, B. W. Cox and B. S. Foster.

—— The Sycamore Electric Light Company, of Sycamore, Ill., has just contracted with the Van Depoele Electric Manufacturing Co., of Chicago, Ill., for a 60-arc light plant and 500 incandescents for furnishing illumination to the citizens of that town.

—— The stringing of electric lights along the wrecked portion of the Pennsylvania railroad was a difficult job. The road runs right along the brow of the mountain, and there was no place to plant poles. The wires were strung on trees in many cases.

—— The Middleborough Electric Light and Power Company and the Middleborough Gas and Electric Company are both busy setting poles upon the streets of the town. The highways present a strange appearance in some places, poles being placed on both sides.

—— Nearly the whole of the $25,000 necessary for the new electric plant at Lenox, Mass., has been raised, and it is proposed to begin the work of putting up the wires and poles as soon as possible. The light will be used by nearly all of the cottagers and for lighting the streets and business places.

—— The Missouri Electric Light Company, of St. Louis, who have the contract for lighting all the streets south of Washington avenue, have ordered four 250 high pressure Westinghouse compound engines for their new station on Twenty-first street and Lucas place, with which they will connect for 3,000 light Westinghouse dynamos.

—— The Willamette Falls Electric Company has started one of its Brush arc dynamos. Portland, Ore., is now lighted by electricity sent 15 miles. The experiment proved a grand success, the loss of electricity in transmission being much less than was anticipated. The company has now six large copper wires strung and intends to supply power for running all kinds of machinery at once.

KINDRED INTERESTS

MANUFACTURING NOTES.

The John A. Robertson Company, of 393 Federal street, Boston, have done some artistic work in the line of inside mouldings, etc., for Boston and New England companies. Wooden dynamo frames are also a specialty, and the electrical branch of the large business is receiving particular attention.

The Electrical Supply Company, of Chicago, have issued a circular descriptive of their new instantaneous armature protector, recently designed and now put upon the market. They may be attached to any arc dynamo made, of any winding, and the company guarantee that the protector will absolutely prevent the armature from short circuiting or burning out.

Bartlett & Company, the engravers, are constantly adding to an already enviable reputation for artistic wood cuts and engravings. The engravings of the Clark dynamos and apparatus, appearing elsewhere in this edition, are excellent samples of the high class work this progressive young firm is daily turning out. The REVIEW takes pleasure in recommending the firm of Bartlett & Company for the execution of artistic work, such as is rarely seen in this city.

The Pond Engineering Company, of St. Louis, Chicago, Kansas City and Omaha, among many other valuable specialties, are handling the Lowe feed water heater and purifier in the West. A pamphlet descriptive of the Lowe heater and containing much interesting information on the subject of heaters and purifiers in general has just been issued by the Pond Company. Among special advantages of this system are the use of brass tubes only with provisions for expansion, easily accessible for cleaning, and built of either the vertical or horizontal pattern.

James Leffel & Company, of Springfield, O., and New York, makers of the well known water-wheel bearing their name, have just issued a neat little volume in pamphlet form which is overflowing with interesting information for those using or about to use water power. It is, in fact, an encyclopedia of knowledge in this particular line, and also devotes some space to descriptions of the Leffel wheels, which are made in all sizes and adapted for every variety of work. The fact that the company has put out 15,000 of their wheels in various parts of the world bears testimony to their experience. A useful feature of the book is a chapter of problems such as are met with in actual practice, with solutions.

The Westinghouse Electric Company have put out their new meters among their various central station companies to the extent very nearly of 100,000 16-c. p. lamp capacity. The meter seems to do the work for which it is designed very satisfactorily. Among the orders for alternating current central station apparatus recently received by the Westinghouse Company are the following outfits: Sioux City, Iowa (increase), 750 lights; Clinton, Ill. (increase), 750 lights; Yankton, So. Dakota, 750 lights; Guthrie, Ind. Ter., 750 lights, and 35 Waterhouse arc lights; Birmingham, Ala., 1,000 lights; Jersey City, N. J., 750 lights; Seattle, Wash. Ter., 750 lights; Montesano, Wash. Ter., 500 lights. These orders bring the number of Westinghouse central stations up to 178.

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* * The New Brunswick Carnival Association under whose auspices the Summer Carnival and Electrical Exhibition are to be held this summer, opening July 22d, have issued an illustrated supplement to the St. John Telegraph, showing the possibilities of electricity, many of which, as realities, will be shown at the exhibition. A trip to St. John might well be made the feature of a summer vacation.

Hand or Bench Lathes.

What modern practice has done for machine tools is very well shown in the single instance of bench lathes. These tools have been on the market for years, but it is only recently that they have found much favor with machinists. The chief reason for this is because they formerly lacked the quality of *handiness*, now they find favor because this quality has been added. Modern practice has taken up this part of the matter until bench lathes are made so convenient that they are fact coming to be considered indispensable in many shops where no use for them was formerly found. Their utility has been chiefly increased by the adoption of quick means of stopping and starting, and the employment of various small tools and appliances that have come into use mainly during the past ten years. The metal in revolution is light in comparison with floor lathes used for small work, and with approved means of stopping and starting, these operations consume but little time at high revolution, hence the speed is likely to be kept nearer what it should be for small work than what it would be with a heavier and more unwieldy lathe.

The Brown & Sharpe Company, of Providence, have recently issued a pamphlet on the subject of the construction and use of the Universal Hand Lathe, made by them. A general view of the lathe as placed in position is shown in Fig. 1.

As there shown, it rests upon a table, but is frequently used as a bench lathe and is furnished without the table.

To prevent the bed from being sprung or twisted when the lathe is set, there is a pin in the top of one of the legs, which allows it to swivel sufficiently to compensate for any slight unevenness of the floor or bench. The other leg is firmly secured to the bed.

The top of the bed is flat, and is scraped to surface plate. It affords a bearing over its entire width for the foot stock, and slide or other rests. The bearing surfaces of these are also scraped.

The foot stock is fastened to the bed by a clamp screw, and can be easily shifted, or taken from the bed; its spindle moves in a steel bushing, and is operated by a hand lever which has its fulcrum on an adjustable stud, back of the spindle. This spindle may be clamped in any position, and has a movable stop *r*, Fig. 1, which serves to limit the forward motion, when brought against the adjustable stop screw *s*.

Fig. 2 shows the tool rest in greater detail. It can be clamped to the bed at any angle, and can also be adjusted vertically.

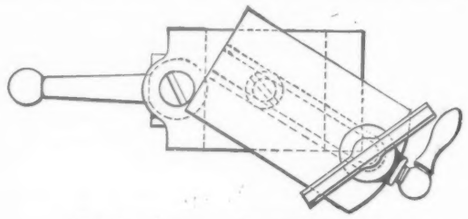

FIG. 2.—UNIVERSAL LATHE TOOL REST.

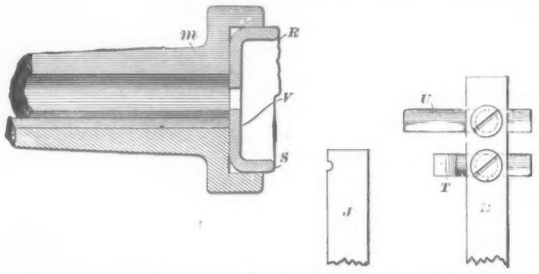

FIG. 3.—SHOWING METHODS OF FINISHING WORK IN THE HAND LATHE.

A method of finishing small caps is shown by Fig. 3. These caps come to the hand lathe from the punch press in the form shown at *R*. The superfluous stock is removed by the tool *T*, and the edge *S* is rounded with a bead tool *J*. The pin *U* is a stop to regulate the depth of the cap by coming in contact with the inside surface *V*. The tools and pin are held in the tool holder shown in Fig. 10, the tools being at right angles to each other. These caps are also bitted and countersunk in the hand lathe.

Perhaps in no other one line of work is there need of such accuracy and delicacy of finish as in the electrical, and the bringing of such machines as the above nearer and nearer to perfection is of the utmost interest to electrical people everywhere.

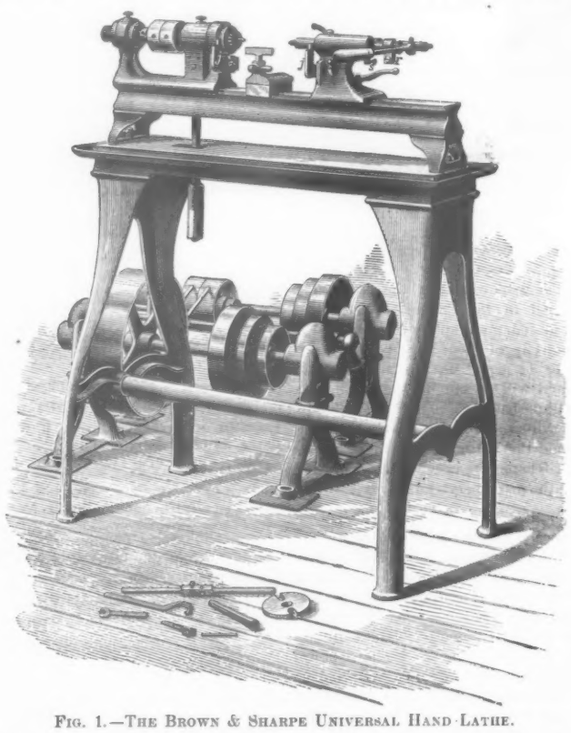

FIG. 1.—THE BROWN & SHARPE UNIVERSAL HAND LATHE.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 11, 1889.

404,816 Incandescent lamp; Charles A. Backstrom, New York, N. Y.
404,822 Induction coil; Fred. H. Brown, Fort Worth, Texas, assignor to the Magneto Telegraph Company, of New York.
404,850 Method of recording and reproducing articulate speech or other sounds; George W. Littlehales, Pottsville, Pa.
404,859 Regulation of alternating electric current generators; Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place.
404,860 Apparatus for indicating the strength of the current in an electric circuit; Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place.
404,861 Method of indicating the strength of the current in an electric circuit; Gustav Pfannkuche, Cleveland, Ohio, assignor to the Brush Electric Company, same place.
404,866 Electric signal for engine shafts; James C. Ricketson, Milwaukee, Wis.
404,867 Electric indicator for engine shafts; James C. Ricketson, Milwaukee, Wis.
404,873 Electric railway; Sidney H. Short, Denver, Col., assignor to the United States Electric Company, same place.
404,877 Underground conductor; George E. Taillieur, Schenectady, N. Y.
404,893 Elevating Machine; James E. Byrne, Brooklyn, N. Y.
404,894 Electrically controlled engine; James E. Byrne, Brooklyn, N. Y.
404,895 Electric elevating machine; James E. Byrne, Brooklyn, N. Y.
404,902 Electrical distribution system; Thomas A. Edison, Menlo Park, N. J.
404,906 Electric alarm-clock; William E. Hadlock, Wenham, Mass.
404,913 Insulated electrical wire; Henry W. Johns, Jr., New York, N. Y.
404,968 Method of distributing electricity by secondary batteries; William W. Griscom, Haverford College, assignor to the Electro-Dynamic Co., of Philadelphia, Pa.
405,002 Brush holder for dynamos; Walter S. Bishop, New Haven, Conn.
405,010 Electrically controlled engine; James E. Byrne, Brooklyn, N. Y.
405,045 Magnetic machine for removing mineral substances from grain; Martin L. Mowrer, Dayton, Ohio.
405,089 Electric self-winding clock; James H. Gerry, Brooklyn, assignor to the Self-Winding Clock Company, New York, N. Y.
405,124 Discharge device for electrical machines; Albert Schmid, Allegheny, assignor to the Westinghouse Electric Company, Pittsburgh, Pa.
405,151 Electric temperature regulator; Lucien F. Easton, La Crosse, Wis.
405,170 Manufacture of filaments for electric lamps; Hiram S. Maxim, Brooklyn, assignor to the United States Electric Lighting Company, New York, N. Y.
405,174 Regulation of alternating electrical current generators; Gustav Pfannkuche, Cleveland, Ohio, assignor to Brush Electric Co., same place.
405,176 Electrode for electric therapeutic body wear; Henry P. Pratt, Chicago, Ill.
405,187 Electric drilling machine; Elmer A. Sperry, Chicago Ill., assignor to the Sperry Electric Mining Machine Company, same place.
405,188 Electric mining machine; Elmer A. Sperry, Chicago, Ill., assignor to the Sperry Electric Mining Machine Company, same place.
405,194 Electro-magnetic transmitter; John T. Williams, Mount Vernon, assignor to the International Portelectric Company, New York, N. Y.
405,196 Galvanic battery; John A. Barrett, Brooklyn, N. Y., assignor to the John A. Barrett Battery Company, Baltimore, Md.
405,206 Electric alarm clock; Benjamin Dubinski, St. Louis, Mo., assignor of one-half to Charles B. Budd, same place.
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405,221 Testing apparatus for switchboards; William E. McKivitt, St. Paul, Minn., assignor to the Western Electric Company, Chicago, Ill.
405,222 Electric motor, starting and stopping device; Frank A. Perret, Brooklyn, N. Y., assignor to the Elektron Manufacturing Co. of New York.
405,235 Municipal signal apparatus; John C. Wilson, Boston, Mass., assignor to the Municipal Signal Company, Portsmouth, N. H.
405,259 Apparatus for the manufacture of filaments for incandescent lamps; Hiram S. Maxim, Brooklyn, N. Y.

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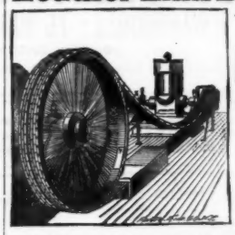

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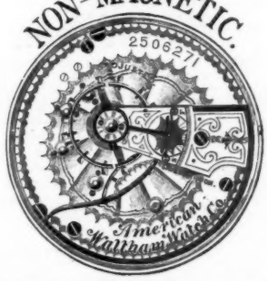

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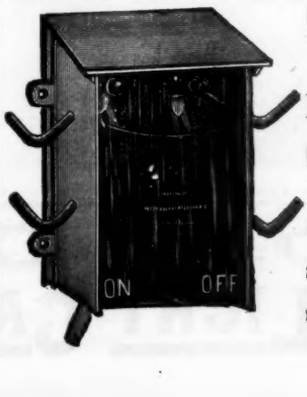

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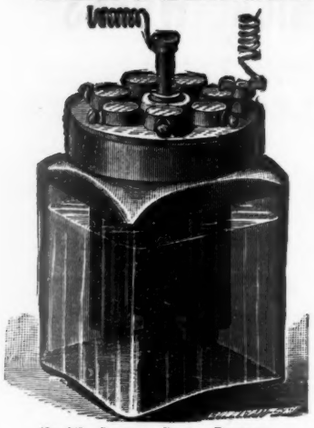

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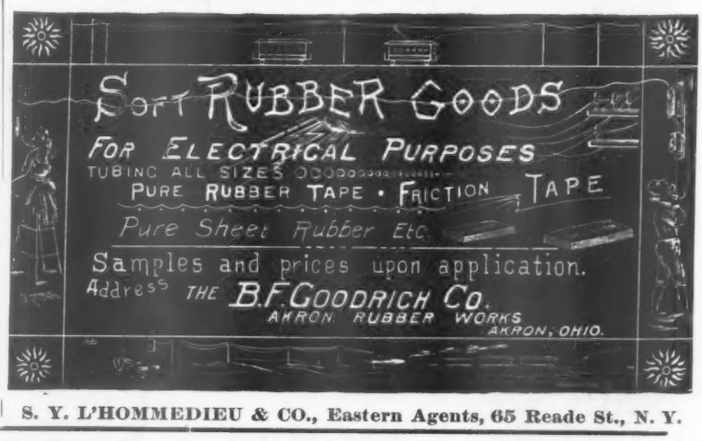

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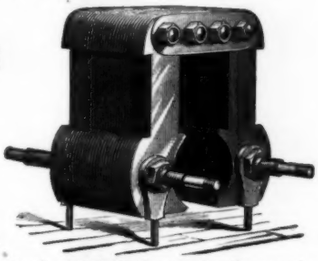

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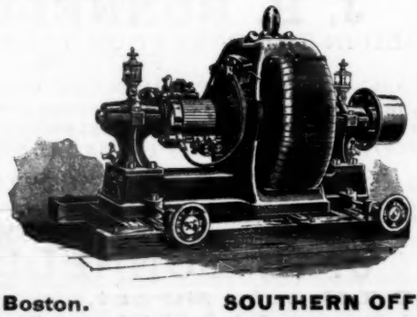

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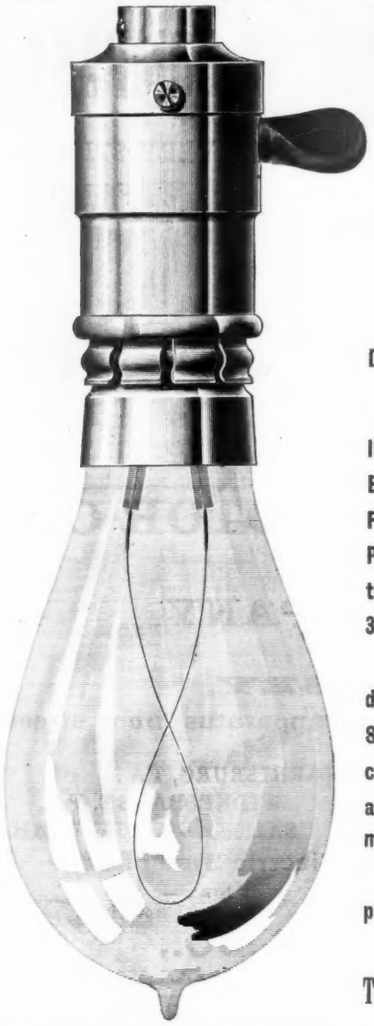

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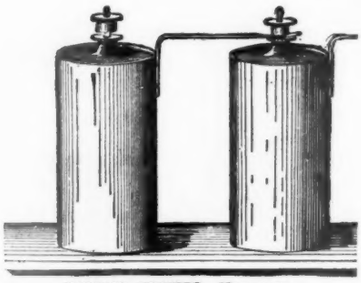

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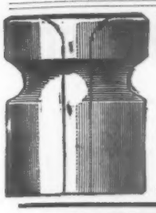

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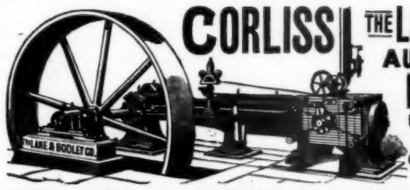

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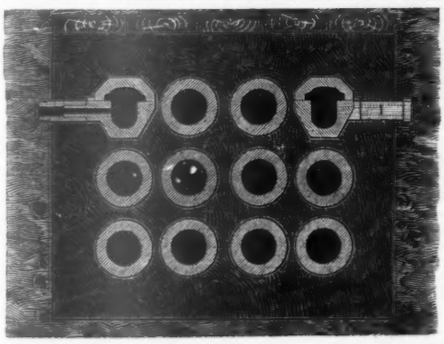

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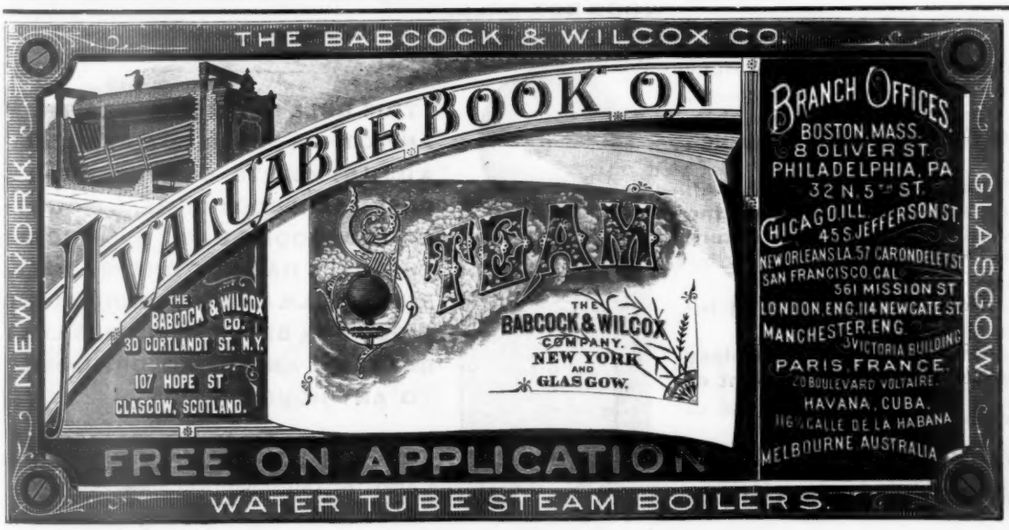
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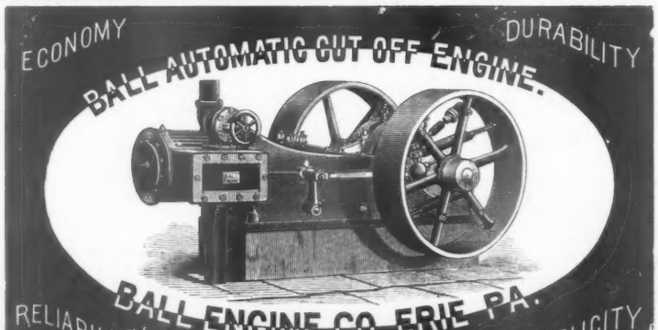

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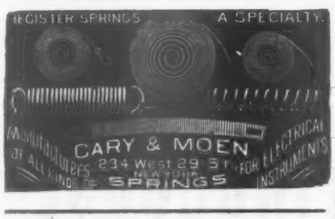

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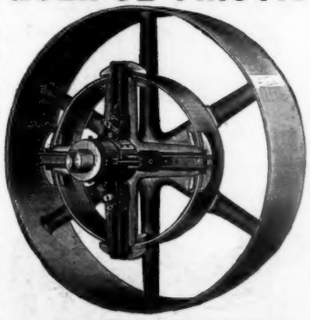

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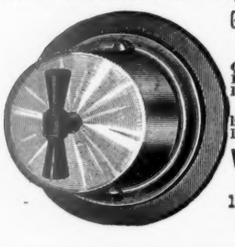

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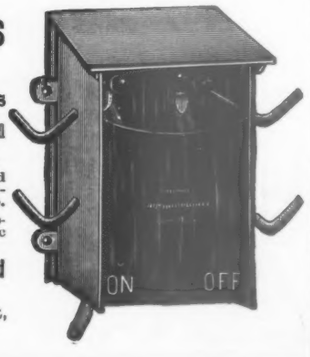

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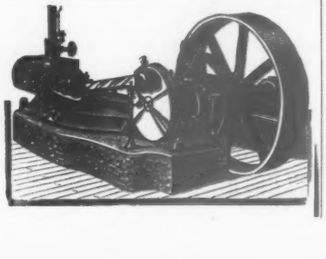

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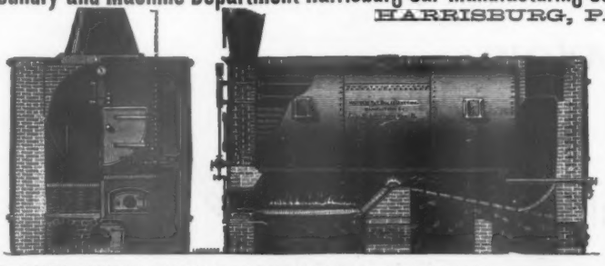

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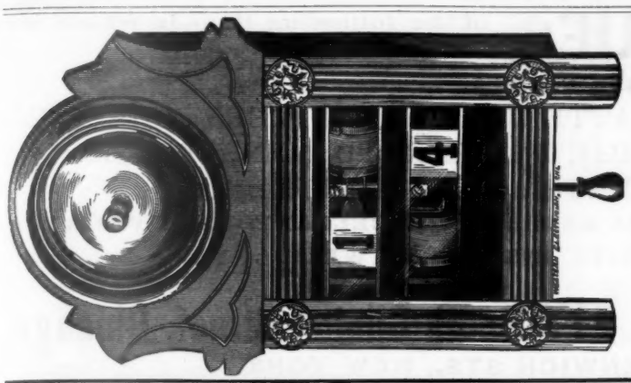

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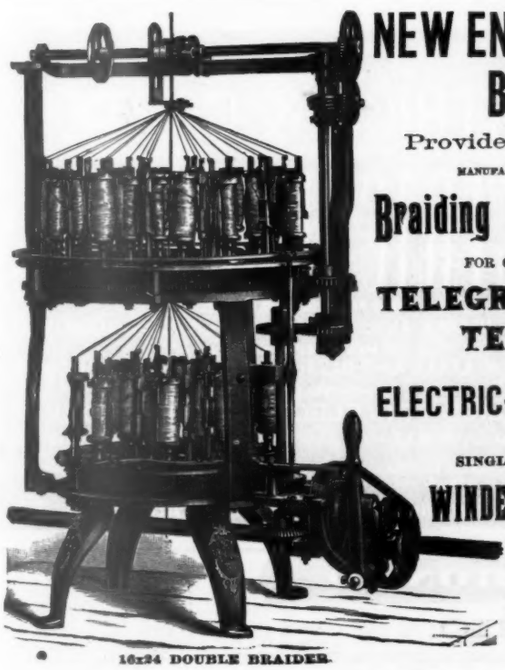

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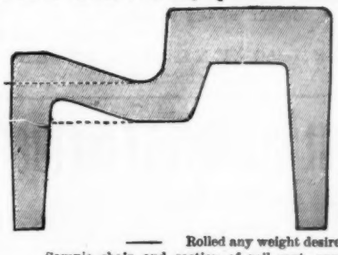

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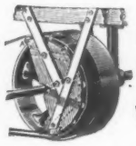

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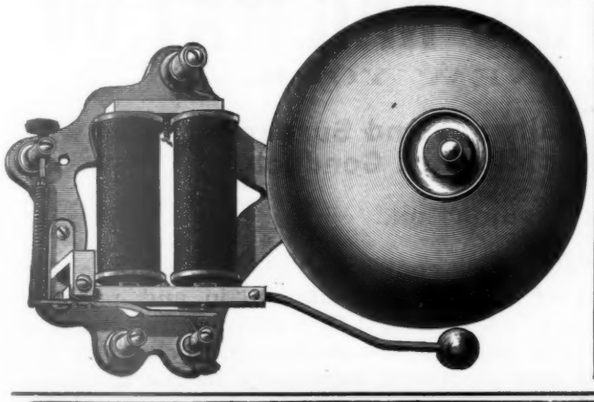

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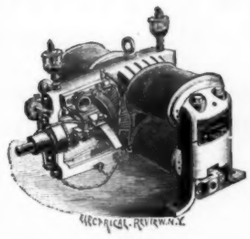

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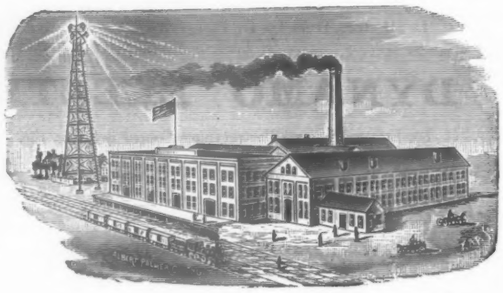

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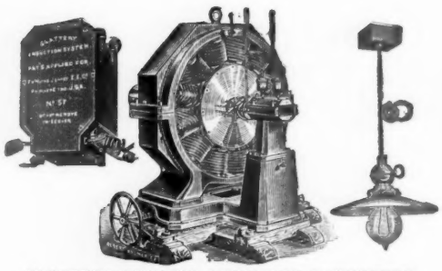

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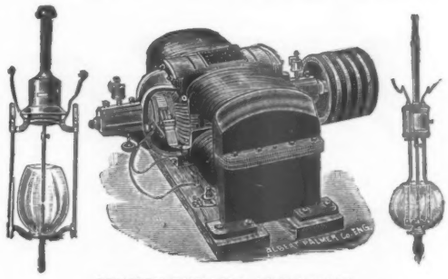

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